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Washington Highlights

The Federal Power Commission has announced that the Southern California Gas Co. of Los Angeles has asked permission to build a natural gas pipeline to serve Imperial Valley, Calif. The line proposed would connect near Desert Center with the existing 1,200-mile carrier from gas fields in the Texas Panhandle to Los Angeles.

By a vote of 7 to 4 the Senate Commerce Committee killed the controversial Moore-Rizley bill which was designed to amend the Natural Gas Act. The measure, passed by the House a year ago, would bar the FPC from jurisdiction over the production and gathering of natural gas in fields.

Interior Secretary Krug was an interested visitor at the International Petroleum Exposition and Congress at Tulsa, Okla. The world's leading oil men heard him discuss synthetic fuels. "Any oil man," he was quoted as saying, "who feels that the Government is about to compete with him in synthetic fuels is welcome in my office to discuss taking over the development of commercial scale plants. If no oil or other interests are willing to undertake the job, then it will be up to Congress to determine the extent to which the Government should go in assisting in the program."

The House Commerce Committee, meanwhile, has approved a measure under which Federal financing for a synthetic fuel industry on a commercial scale would be conditional. The bill authorizes the RFC to expend or lend a maximum of $350,000,000 for the construction of plants to produce gasoline and fuel oil from coal and oil shale. The RFC also would be permitted to enter into 10-year contracts to subsidize the manufactured output of synthetic institutions.

The Senate has confirmed the reappointment of Harrington Wimberly of Oklahoma as a member of the Federal Power Commission. He is vice chairman of the commission.

A House Armed Forces subcommittee recommended that President Truman appoint a special commission to solve what was described as a critical condition of petroleum in the event war was to come to the United States. This commission would give particular attention to allocation of steel to the petroleum industry, oil stockpiling for the armed forces, exploitation of potenial oil ground and the setting up of new petroleum reserves for the armed forces.

How non-oil producing states stand on the tideland issue may be deduced from recent utterances on the subject made respectively by two members of Congress.

Representative Horan of Washington made his position clear by stating "while the spotlight in the tidelands controversy has been aimed at the highly prized oil resources along the shores of California and Texas, our state of Washington has a definite interest in the case. To me it is somewhat startling that the Federal Government never seriously asserted a claim to the disputed lands until certain Government officials became aware of the rich resources underlying them. As I am sure most witnesses on this subject will testify, the great bulk of precedent holds that such lands have always rightly been the property of the several states. If the Federal Government should be empowered to assert ownership to any portion or classification of lands in which important resources should be discovered, there would be little left to prevent it from asserting title to mineral deposits under the mountain tops, as well as under the sea water. We might easily jeopardize the status of virtually every important piece of property in the nation."

Remarked Representative Foote of Connecticut, "the decision in the California case opens the door to claims of other parties that the owner of a pier or an oyster franchise or lease does not have a proper title. Endless litigation is foreseeable, all of it subject to adjudication by the United States Supreme Court.

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Application of Secondary Recovery in the United States As Related to Emergency Oil Requirements

By Paul D. Torrey
Houston, Texas
Consulting Engineer,
Chairman, Standing Subcommittee on Secondary Recovery Methods, American Petroleum Institute,
Chairman, Advisory Committee on Secondary Recovery, The Interstate Oil Compact Commission

ABSTRACT:

The shortage of liquid fuels which developed in recent months focuses attention on the ability of the petroleum industry to supply the future domestic demand for oil in the United States, and more particularly the emergency demand for oil which would be required for the defense of the nation in the event of war. The shortage of oil is being used as an excuse for greater federal control of the industry. If the industry can demonstrate positively its ability to supply both ordinary and emergency demands, much of the argument for federal control will be eliminated.

The amount of oil required to meet the estimated ordinary and emergency requirements of the nation could not be produced continuously without serious damage to the ultimate recovery of presently known primary reserves. Competent authorities have presented evidence that the immediate future ordinary demand for oil can be met, but there is certainly serious question whether existing primary reserves are adequate to supply a prolonged emergency demand.

Since the development of new production from prospects in the Tidelands is being retarded by federal action, the most promising approach to the problem of supplying oil for national defense may be found in the more general application of methods for increasing the recovery of oil from known reserves. The reserves of oil which will not be recovered by present production methods are tremendous. As an example, the oil which will remain in permeable Permian reservoirs of West Texas alone, and which should be susceptible to improved recovery technology, is abundantly sufficient to supply the maximum estimated demand for national defense for a period of about 6 years, if it could be made available at the desired rate.

There is undoubtedly some point where secondary recovery operations in deep fields and in thin reservoirs will not be profitable because of competition from synthetic and substitute fuels. Production of liquid fuels from natural gas is already an accomplished reality, but as long as the industry can expand production to conform to demand and can utilize gas for which there is no direct or profitable market, such operations should not retard the development of a large majority of presently known secondary prospects. Competition from synthetic fuels produced from coal and from oil manufactured from shale is more remote, and has little bearing on the profitable application of secondary methods in most fields where promising additional recovery possibilities exist.

The application of pressure maintenance to recently discovered oil reservoirs, where efficient, unaided primary recovery cannot be expected, is even more important than obvious applications of secondary methods in older fields. However, in many cases neither pressure maintenance nor secondary recovery operations are feasible unless it is

At Continental Oil Co.'s Bixby 58 in the Seal Beach Field, Bell & Burden drilling contractors. Rear row, left to right: M. C. Wofford, lead tong; J. C. Harbin, driller; C. R. Cooper, derrick. Front row, left to right: J. A. Hickman, cat head, D. L. Saunders, back up.

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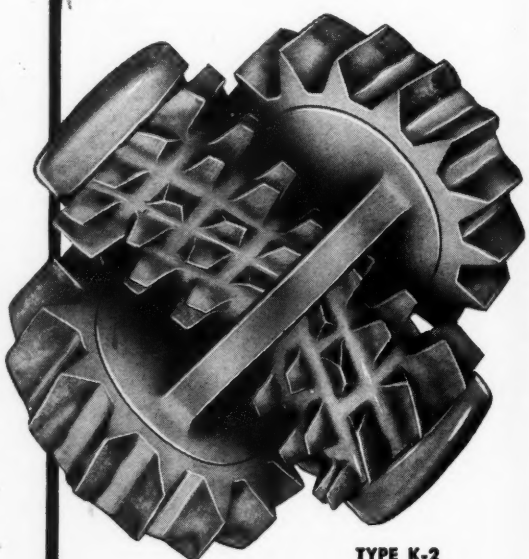

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possible to unitize the field, and this cannot be done as long as laws are inadequate or lacking.

Wells will be an essential part of most secondary operations, consequently, no oil well should ever be abandoned without giving consideration to the effect such action will have on future possibilities for increasing recovery. With vast sums being spent each year in an effort to augment existing oil reserves, the promising prospects for securing more oil from presently known fields are deserving of careful attention. Work now in progress by the American Petroleum Institute will help to evaluate better these prospects.

INTRODUCTION:

Only a few months have elapsed since the petroleum industry of the United States, for the first time in its history, has been confronted by the dilemma of being unable to meet the demand for its products.

A multitude of reasons have been advanced for the shortage. Most industry representatives, although admitting the existence of a scarcity of refined products, have testified that shortages are temporary, are susceptible to correction, and are not due, necessarily, to any over-all dearth of oil in the United States.

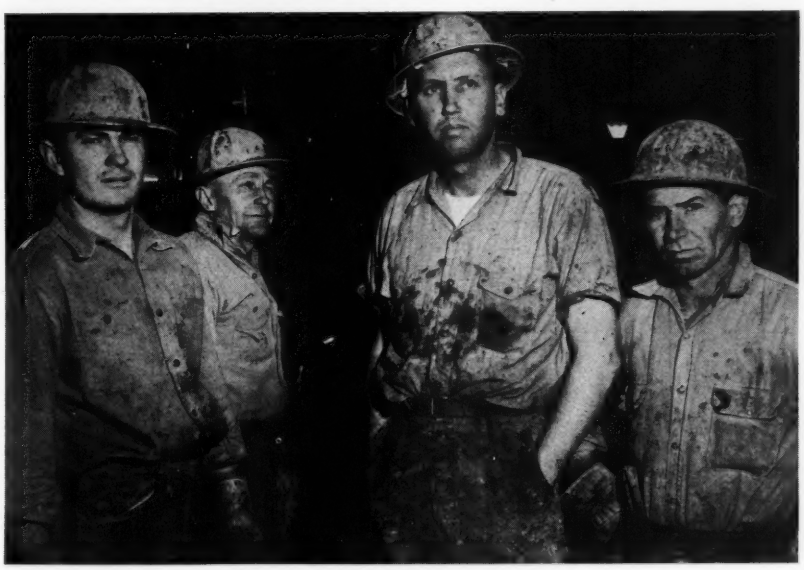
Among the causes which have been cited for the shortage of oil are: Limitations in transportation facilities, and a substantial deficiency of steel that has been needed so badly for drilling and production equipment, for new pipe lines and tank cars, and for new refinery construction. Even with these deficiencies, the supply situation might not have become so aggravated had not abnormally severe weather accentuated the demand, and at the same time affected seriously the retail delivery of liquid fuels. No one can deny that there have been very definite changes in the fuel consuming habits of the American people, and it has been apparent for quite a few years that as long as oil and gas remain plentiful and cheap, they have no difficulty in replacing coal. Low price as well as great convenience has converted a large section of our population to the use of oil, and, as a result, in 1947 the energy requirements supplied by petroleum and its products for the first time in history exceeded those obtained from coal.

It is not the purpose of this paper to consider problems of supply and demand, except as they may bear directly on the application of secondary methods. However, it does seem appropriate to remark that the conclusions reached by the API Committee of Eleven[1] in September, 1925, are just as pertinent today as they were over 20 years ago, and that they have direct bearing on many phases of efficient oil recovery technology. This Committee, in considering measures for insuring a supply of oil sufficient for the needs of the nation, recommended that the right to own and lease oil lands be made secure; and that those engaged in the industry be permitted to exercise initiative, have liberty of action, enjoy free competition, and receive prices for petroleum and its products commensurate with the risks involved and the capital invested. The necessity for preserving the rights and conditions, which the Committee of Eleven stated were essential for the the maintenance of adequate crude production, becomes impressively apparent when it is recognized that certain officials of the federal government have been utilizing the acute supply situation as an argument to secure controls over the industry and the price of its products and, to justify the expenditure of vast sums in the development of a synthetic fuel industry. Consequently, anything that can be done through the industry's own initiative to demonstrate ability to supply oil when and in the amount it may be needed, both for ordinary and for emergency needs, will help to erect a formidable defense against what seems to be ever present danger of encroaching federal authority.

The results obtained from the application of secondary methods[a] in various parts of the country can be utilized impressively in arguments against federal control for unique reasons. These methods have been developed by and for the industry, and their application can always be cited as direct recognition of the responsibility to assure the maximum, economic recovery of oil. Efficient primary oil recovery many times is taken for granted, and is regarded merely as an example of good business, whereas the oil produced by secondary methods carries with it the special significance of salvaging a valuable resource which otherwise might be irretrievably lost.

An Ever Increasing Demand for Oil

In most of the recent discussion, there seems to be general agreement that nothing less than a national calamity will serve to diminish the current and future demand for petroleum and its products. The Economics Advisory Committee of



In the Huntington Beach field, at Southwest Exploration Co.'s well, State J-61. G. A. McClelland, cat head; L. Wertzbaugher, driller; G. A. McDonald, pipe racker; M. Porter, lead tong.

the Interstate Oil Compact Commission,[2] a recognized authority on the subject, has predicted that the 1948 demand for petroleum in the United States will amount to about 6.2 million barrels per day. This represents an increase of nearly 6 per cent over 1947, and an increase of almost 35 per cent during the past 5 years. If the possible emergency requirements for oil, recently estimated by the Secretary of Defense, are taken into consideration, the conceivable demand in this country in the event of war might exceed 8 million barrels per day. Obviously, oil in this amount could not be produced continuously without serious damage to the ultimate recovery from the nation's present primary reserves. Therefore, even though it might be possible to make some temporary increase in production, an emergency, which might eliminate foreign imports, would necessitate drastic restrictions in civilian consumption to insure requirements for national defense. When consideration is given to figures of such imposing proportions, and to the troubled conditions in the Near East which might eliminate an important world source of crude supply, it can then be understood why attention is being given to the possibilities for production of synthetic fuels from natural gas and coal, and to the manufacture of oil from shale.

Ability of Industry to Meet Demand

How far this country may go in the immediate future in the development of auxiliary supplies of liquid fuels will depend on several factors, some of which have already been mentioned. If, for instance, we could be assured of a continuity of foreign imports to supplement domestic production, and of prices which will reflect the true value of crude petroleum and its refined products, the future liquid fuel requirements of the United States could be viewed with considerable equanimity. Also, as an alternate, if security from dependence on foreign imports of oil can be established by the discovery of large new reserves in the continental United States or in the Tidelands, or if increased recovery from existing reserves can be assured, the immediate justification for large competitive expenditures by the government will be removed. The Economics Advisory Committee of the Compact[2] has stated emphatically that the immediate future ordinary demand for petroleum can be met providing no disturbing conditions arise. This well-informed Committee, in considering the effort which has been made to supply liquid fuels, commends the petroleum industry for the amazing success it has achieved under the very difficult conditions which have prevailed.

The Independent Petroleum Association of America,[3] in its comprehensive and thorough analysis of the problem of required material supply for the oil industry, offers a possible solution to the problem by showing that a direct relationship exists between drilling activity and the maintenance of our reserve position. If past experience can be accepted as a reliable criterion, this study should serve to assure the nation that its peacetime requirements for oil can be met if resources and supplies to enable the drilling of many wells are made available. The promising trend in discoveries in 1947, when additions of some 3.26 billion barrels were made to the primary reserves, encourages the thought, for the time being at least, that such an assumption is probably valid. It might continue to be so if presently known exploration tehniques can provide new oil fields at the rate of former discoveries. However the record of the past decade creates some apprehension that this may not be done, and that it might not be possible to provide from primary reserves alone all of the additional oil which might be needed desperately in a time of emergency. It would be imprudent to disregard the well-established fact that the net reserves discovered by each successful wildcat well have declined steadily in recent year, thus indicating rather conclusively that the industry is finding it more and more difficult, and certainly more and more costly to discover fields of major importance.

A factor which complicates all thinking on the future oil production ability of the United States and its relation to possible emergency needs, is the question of the little proven but presumed large reserves which exist in the Tidelands. The orderly exploration and development of these offshore prospects are being retarded by the attempt of the federal government to secure their control. Until the Congress can establish the rights of the several states, the uncertainty of the situation makes difficult the proper evaluation of what may prove to be

At the Del Amo Oil Co. well No. 102 at Torrance. Atlantic Oil Co. drilling contractor. Left to right: Fred Schwarz, cat head; Bill Taggart, driller; Virgil Redfern, derrick; Al Matthews, floorman.

the easiest opportunity for reversing the recent discovery trend.

Increasing Recovery From Proven Reserves

No one can question the necessity for giving preferential attention to that oil which may be required for national defense. Consequently, since the prospects of the Tideland cannot be determined immediately, it is believed that a most promising approach to the problem of assuring emergency oil requirements may be found in the definite possibility of increasing recovery from presently defined reserves.

Recently, in a very thought-provoking paper by Minckler,[4] it has been emphasized that California, which has been an oil exporting state for many years, may not be able to supply the forecasted demand for the Pacific Coast states in a period of a few years unless large new discoveries are made or unless drastic measures are taken to increase recovery from known reserves. The convincing arguments advanced by Minckler could be incorporated directly into this discussion, and would cause no alteration in the conclusions. Actually, a couple of states already have reached the point where primary production has not been sufficient to meet the demand, and others are rapidly approaching the predicament which may soon confront the California oil industry.

Fortunately, techniques for increasing oil recovery from many of the older fields have been in process of development over a period of almost 30 years. It should be possible to utilize these methods to great advantage and to benefit from the experience that has been gained previously. Pennsylvania, for instance, has developed successfully methods which have served to prolong the life of its oil industry. Subsequently, this demonstrated ability to increase the recovery of oil has found wide application in other regions that have been confronted by diminishing production and negligible new discoveries. Such being the case, the over-all picture does not appear too discouraging, and, in fact, in the light of past experience, the maintenance for many years of profitable production in most of the oil states can be regarded as possessing very promising possibilities.

The Magnitude of Unrecovered Oil Reserves

The magnitude of the unrecovered oil in the Unitied States has never received the attention which it deserves. Investigations in progress by the American Petroleum Institute and by the Interstate Oil Compact Commission should supply in the near future more authentic information than can now be presented. However, there is no question but that the amount of oil which will remain in many reservoirs by present recovery practice is tremendous.

Recently, a preliminary study by the writer indicated that the original oil content of the Permian reservoirs of West Texas amounted to some 26.23 billion barrels of oil, an amount substantially greater than the accepted primary recoverable reserve of the United States. This study revealed that 11.70 billion barrels of oil occurs in rocks which will contribute little or nothing to primary recovery, leaving some 14.53 billion barrels in permeable reservoirs from which an ultimate primary recovery of 4.79 billion barrels of oil is expected. With an indicated average recovery efficiency of 32.9 per cent, there will be left in the more permeable strata of these great reservoirs the very considerable quantity of some 9.74 billion barrels of oil.

The immensity and importance of these accumulations will be more evident when it is appreciated that the combined original oil content of five prominent Permian reservoirs: Wasson, Fullerton, Slaughter, North Cowden, and Yates was slightly over 11 billion barrels. This amount approaches the total primary reserve of Texas.

Unfortunately, it cannot be estimated positively and for every field the part of this anticipated residual oil which can be recovered by the application of secondary methods, or, preferably in the younger fields, by proper control or primary reservoir energy. Some of the West Texas fields, where reservoir energy has been conserved, will have superior primary recovery. However, in general the abundance of oil which has been available for over 20 years, combined with low prices, low production allowables, and the inability to unitize the University and Public School lands, have not encouraged the application of improved recovery methods in most of the older fields. The few gas injection and water flooding operations that have been attempted in West Texas for the most part have been poorly conceived, inadequately developed, and inefficiently operated. Frequently, secondary

In the Huntington Beach field, Kohlbush well No. 12. Pacific American Drilling Co., contractors. Rear row, left to right: David Jenkins, rotary helper; O. O. Dennis, driller; D. R. Bain, derrick; front row, left to right: H. A. Anderson, cat head; J. P. Whiddon, rotary helper.

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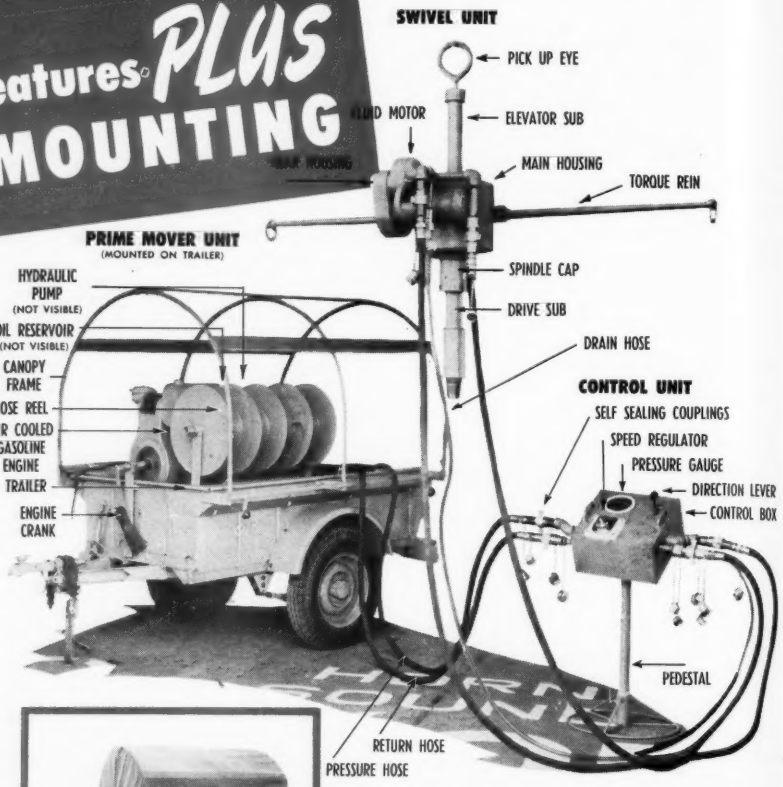

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recovery has been employed merely as an excuse to preserve deep rights on leases which otherwise would be lost by expiration. Nevertheless, favorable reaction in a few instances to the injection of gas or water has been proven, and, if methods developed in the Eastern States can be applied successfully, or if other techniques adapted to the peculiar conditions of irregular permeability which characterize the limestone and dolomite reservoirs can be discovered, it is indicated that the total primary recovery from many solution gas drive fields might be doubled by the proper application of secondary methods or pressure maintenance, depending on the age of the field. In such case, additional oil that might be produced in West Texas, could be sufficient to provide the estimated emergency requirements for the defense of the nation of 2 million barrels per day for a period of almost 6 years, if it could be made available at the desired rate.

It is hoped that the foregoing figures will not be accepted too literally, for in some respects they are not complete. They have been cited for the principal purpose of illustrating the added recovery possibilities of only a part of one very important petroliferous province of the United States. It is more important to remember that this great West Texas oil reserve, and the reserves remaining in other like areas of the United States, do not require discovery. The oil has not migrated appreciably since it was first found, and the areal extent and magnitude of the reservoirs have been defined in most instances. Many of the fields are in advanced stages of development, so all additional recovery that can be obtained will serve to enhance the return on investments which have already been made.

Since West Texas is only one of the many important oil producing areas of the United States, the conclusion cannot be escaped that this country is abundantly supplied with oil and that much of this oil will not be recovered by the production methods now in use. However, it should be recognized that effective oil recovery techniques, just like the conservation of soil and forest resources, have not always been known, and their development has taken place over a period of quite a few years. Likewise, for many years the price received for crude oil has been in no way commensurate with the value of the product, and has not permitted, in many instances, a normal replacement of produced reserves. As a consequence, in some important areas, such as West Texas, it has not been profitable in the past to apply methods for increasing oil recovery.

Some Economic Considerations

W. B. Berwald,[5] in a paper presented at the 27th Annual Meeting of the American Petroleum Institute, has discussed adequately many of the factors which control the profitable operation of secondary recovery projects. The same factors which have controlled secondary recovery activity in the past and at present, such as property valuation, development and operating expense, quality and desirability of crude, and the profit which may be anticipated, will continue to govern the economic success or failure of future secondary recovery operations. As indicated by Berwald, all secondary recovery activity will be limited by changes in price structure which might accompany the discovery of large new primary reserves in the United States, or in the adjacent continental shelf. Also, there is undoubtedly some point in the future where secondary recovery operations in deep fields and in thin reservoirs cannot be profitable because of competition from synthetic and substitute fuels.

Possible Competition

Interest on the part of the industry in the production of synthetic fuels may not be based, necessarily, on fears of an impending oil famine. Rather, it would seem that the trend of much of the recent research and planning has been directed to the conservation of gas for which direct and profitable markets may not be available. The commercial production of liquid fuels from natural gas under the conditions indicated, definitely offers the best immediate opportunities, and should be recognized as such. However, it cannot be conceived that such operations will be competitive for some time to come with much of the increased oil that may be secured from presently known secondary recovery prospects unless they receive heavy subsidy from the government.

Extensive competition by liquid fuels produced from coal with secondary oil does not appear likely in the immediate future. The convincing evidence on this subject presented recently by Bruce K. Brown,[6] before the Short Subcommittee of

In the Long Beach field at Richfield Oil Corp.'s well No. A-56, Loffland Bros. drilling contractors. Left to right: K. R. Akers, cathead; J. R. Grimes, rotary helper; E. J. Smith, driller; Donald Curry, pipe racker.

the House of Representatives, is worthy of consideration. It was emphasized by Dr. Brown, in his conclusions, that the liquid conversion program proposed by the government would require an increase of at least 60 per cent in the total production of coal and the number of miners in the United States. He also estimated that the energy value of the synthetic fuel would be about one-third of that of the coal put into the process.

In other recent testimony before Congressional Committees, there has been rather general commendation of research both by the government and by industry on methods which will serve to guarantee a domestic fuel supply adequate for all eventualities. However, most authorities have concluded that it is uneconomic to produce synthetic fuels from gas or coal for purposes which can be served more efficiently by burning gas or coal directly. Also, a continuation of expansion by industry in the production of synthetic fuels, as rapidly as economic conditions may require, has been favored, but there is general agreement that the steel and other equipment required to embark on an extensive program of synthetic fuel production could be used much more effectively at the present time in an expansion of crude oil production operations.

Similar conclusions may be advanced for possible competition between oil manufactured from shale and much of the oil which may be produced by secondary methods. The estimated reserves of shale oil in this country are large, being in the range of some 92 billion barrels. In his recent report to Congress, the Secretary of the Interior has admitted some of the obvious difficulties connected with the manufacture of shale oil. Evidence developed at the experimental plant at Rifle, Colorado, indicates that under favorable conditions and large scale operations, oil from shale can now be produced at an estimated cost of from $2.00 to $2.50 per barrel. However, the products from shale oil are inferior to those obtained from most crude petroleum, and it is difficult to refine. These factors, when combined with the isolated location of the most productive deposits, support that conclusion that it will probably be a long time before dependence will be placed on shale as a major source of liquid fuels.

Obviously, as the available supply of crude oil and natural gas declines, more and more attention will be given to substitutes. However, the best available information suggests that for several years to come it will probably be more profitable and more in the interest of national defense to devote principal attention to problems connected with the maximum economic extraction of oil from proven underground reservoirs.

Maximum Utilization of Existing Oil Reserves

The existence of large unrecovered oil reserves has no more significance than the existence of large reserves of oil shale unless methods are available to permit profitable production. Secondary methods now constitute the principal source of oil supply in New York and Pennsylvania, where they have been applied with great success because it has been profitable to do so. These methods are becoming increasingly important elsewhere. However, as the writer has emphasized repeatedly, the need for secondary methods is an open admission of past inefficient primary recovery. With the information that is now available on mechanics of oil reservoir performance, the industry is inviting trouble when wasteful dissipation of reservoir energy is permitted in any field. No reasonable argument can be advanced against a plan that every new solution gas-drive oil field, which has reserves sufficient to justify development, should be operated with adequate pressure maintenance. Thus, in addition to obvious applications of secondary methods in older fields, where much of the original reservoir energy may be exhausted, the general adoption of some form of pressure maintenance for the conditions indicated is even more important, and may insure the recovery of from two to three times the volume of oil which otherwise might be obtained by pressure depletion alone. If the recovery efficiency of many of the country's solution gas drive reservoirs could be improved substantially, much of the present concern over the immediate future oil supply could be dismissed.

Maximum Utilization Dependent on Enactment of Proper Laws

In order to apply secondary recovery or pressure maintenance effectively and economically, the unitization or cooperative development and operation of oil fields is usually necessary. This objective cannot be attained as long as state laws permitting the unitization of oil and gas fields are either inadequate or lacking, and as long as operators are liable for violations of antitrust laws if they join a unit or a cooperative project.

This matter is of such importance that the writer[7] stated in his report to the Executive Committee of the Interstate Oil Compact Commission, at the winter meeting in Oklahoma City, December 6, 1947, as follows:

"After careful consideration of the laws of the various states dealing with secondary recovery and unitization, the Advisory Committee on Secondary Recovery respectfully recommends that the Interstate Oil Compact Commission urge the authorities of every oil-producing state to give thought and consideration to the existing laws which may affect cooperative, pooling, or unitization agreements. The Compact should urge the enactment of new laws or the clarification of old laws whenever the same may be needed to authorize such agreements."

Nothing can be gained by advocating the application of methods for increasing oil recovery as long as they may place the operator in legal jeopardy, and it is certainly desirable that the executives and legislatures of the various oil-producing states should be acquainted with this fact. Opposition to laws permitting unit operations is based usually on either ignorance or avarice, for as far as the writer can determine there are no unsuccessful unitization agreements where commercial oil production has been developed. Such being the case, the facts concerning the general success of unitized operations should receive wide publicity so that objections to unitization resulting from ignorance may be eliminated. Likewise, it seems clear that the oil industry and the states must co-

operate to remove the nullifying effects that may be imposed by a selfish minority, who will purposely obstruct a program of unquestioned conservation designed for the common good of a field solely for the nuisance value it can create.

Prospects for Increasing Oil Recovery

An account of results which have been obtained from secondary recovery operations in various parts of the United States would involve a repetition which is considered needless. However, it should be emphasized that there is great diversity in the results which have been obtained, that all secondary recovery projects are not successful, and that techniques which have proved satisfactory in one area may not find similar successful application elsewhere. For this reason it is felt that much more can be accomplished by some consideration of future oil recovery possibilities rather than by an enumeration of past results, many of which are generally known.

We are prone many times to forget that there are other methods for increasing oil recovery in addition to air and gas injection, and water flooding. The large measure of success obtained in operations, such as the dewatering of the Kern River Field, is a splendid example of what may be accomplished by combining engineering ability with some pioneering spirit. The rejuvenation of this field, after it had been idle for almost 15 years, is an accomplishment of major significance in which the operating company can take justifiable pride.

The results of previous underground oil mining experiments in Pennsylvania are not considered to be economically successful. Surface excavations of oil-bearing strata in Alberta, where the overburden is thin and can be removed at reasonable cost, are being continued, but the remoteness of these great deposits constitutes a handicap that, undoubtedly, will retard large-scale development for a considerable period. However, it is believed that there is ample justification for the development of an oil mine at some strategic place in the United States which would be planned and developed with the specific purpose of supplying the maximum amount of technical information regardless of economic yield. Definite information on the best use of explosives, the question of uncontaminated cores, selective plugging of and selective injection into rock strata, and many other matters connected with the completion and reworking of wells, and the injection of fluids into oil-bearing rocks, should be obtained from such an operation. It is believed that an experimental mine, of the type the writer suggests, should provide specific facts on the measures that must be taken to recover a given amount of oil at a given cost, just as is being done with regard to shale oil in the experimental mining operations in Colorado. Such being the case, it would seem that there could be no better opportunity for the federal government to be of substantial assistance to the oil industry in the performance of basic research than by the sponsorship of an experimental oil mine.

Immediate opportunities undoubtedly exist for working shallow, little depleted reservoirs which contain heavy, viscuous crude. Such operations might include partial or complete excavation, experiments in the application of heat, and possibly the preliminary dilution of the reservoir fluid with light crude to make the heavy oil more mobile, and, thus, easier to remove with moderate pressure differentials. Actually, there is an amazing amount of heavy, viscuous crude in shallow reservoirs in various parts of the United States which cannot be produced by conventional secondary methods because the reservoir rock strata cannot withstand the excessive pressures necessary to move the oil in its natural state. The urgent demand for heating oils should certainly provide a good incentive for a careful consideration of methods whereby known reserves of heavy crude may be recovered efficiently and profitably.

Virtually all methods for increasing oil recovery probably will be associated in some way with the injection of fluids into oil-bearing rocks. Interesting possibilities such as:

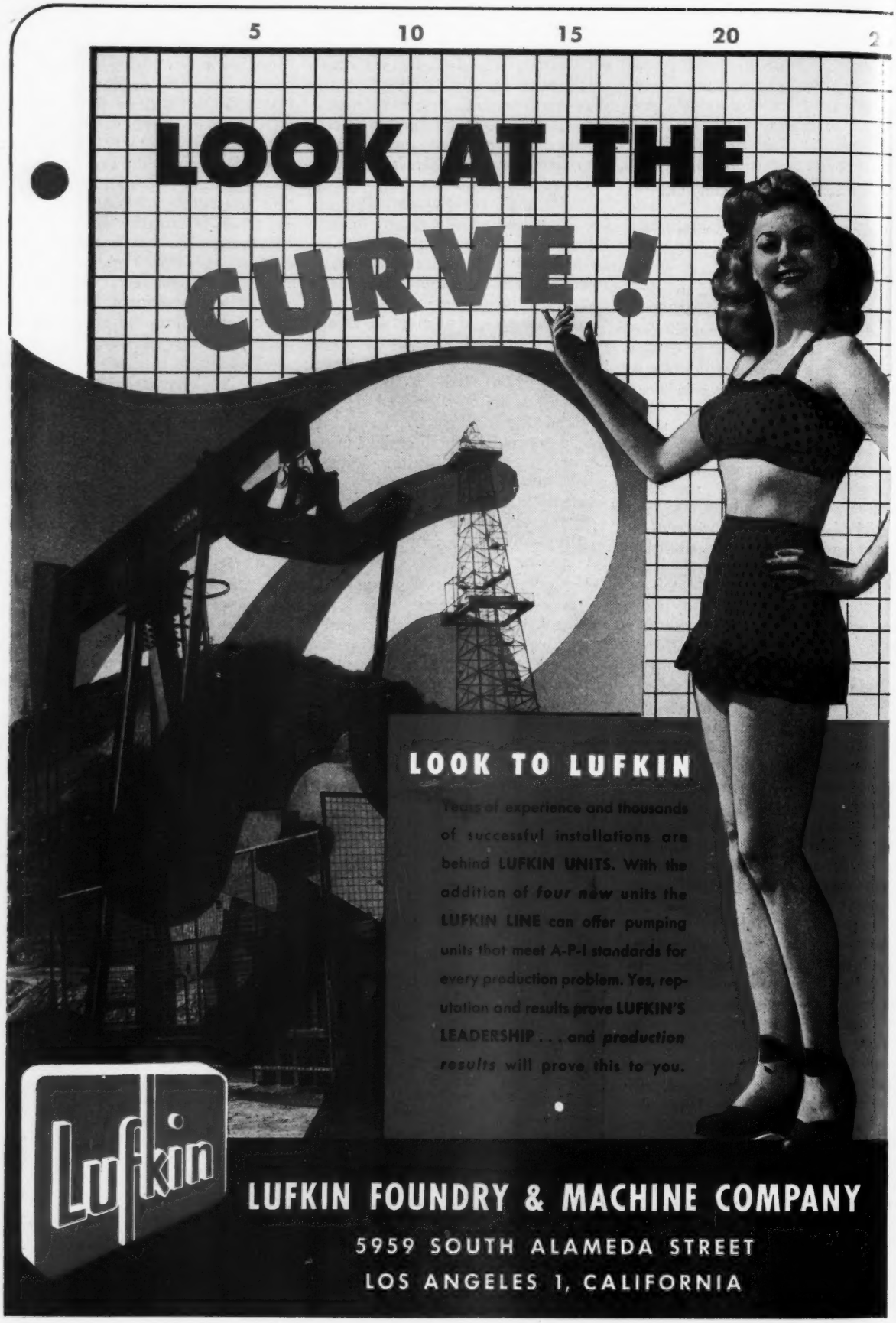
1—The release of oil by bacterial action.

2—Studies of the physical chemistry of reservoir surfaces, particularly with the objective of increasing permeability to oil, and decreasing permeability to gas and water.

3—Underground hydrogenation in deeper fields to improve the mobility of reservoir fluids by the actual lightening of the hydrocarbon molecules.

and others, if developed to the point of practical field application, undoubtedly, will require the utiliza-

Santa Fe Drilling Co., contractors for Standard Oil Co.'s well No. B-114 at Huntington Beach. Rear row, left to right: Ralph East, driller; J. W. Spurlin, cat head; M. Ledbetter, derrick; front row, left to right: Ray Elder, lead tong; "Swede" Manson, back up.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tion of injection techniques which, although by no means perfect, have been improved greatly by extensive utilization in secondary recovery operations. For this reason, and excepting, of course, various phases of mining operations, it cannot be foreseen how the use of wells can be avoided in almost all oil recovery projects. As long as wells will be required, much attention certainly should be devoted to the development of methods whereby existing wells can be utilized most effectively for both injection and production purposes. Too much emphasis cannot be placed on this problem, for it may not be profitable to redrill entirely an oil field for secondary recovery operations.

Since wells will be an essential part of practically all secondary operations, it should be obvious that no well should be abandoned until consideration is given to the effects that such abandonment might have on future attempts to increase recovery. Also, it is believed that all new completions should be planned, even though pressure maintenance or secondary recovery are not considered to be immediately expedient, so that the wells can be employed with the least cost and trouble for any oil recovery program which may be adopted subsequently.

Opportunities for Research in Oil Recovery Technology

For many years the oil industry has spent large sums in refining research, which has resulted in lowered manufacturing costs, reduced sales prices, and improved products. It would appear plausible that a similar measure of success could be expected if the same liberality should be devoted to studies of methods for increasing oil recovery. The splendid results which have been obtained from oil recovery research in Pennsylvania are most impressive and surely support this conclusion.

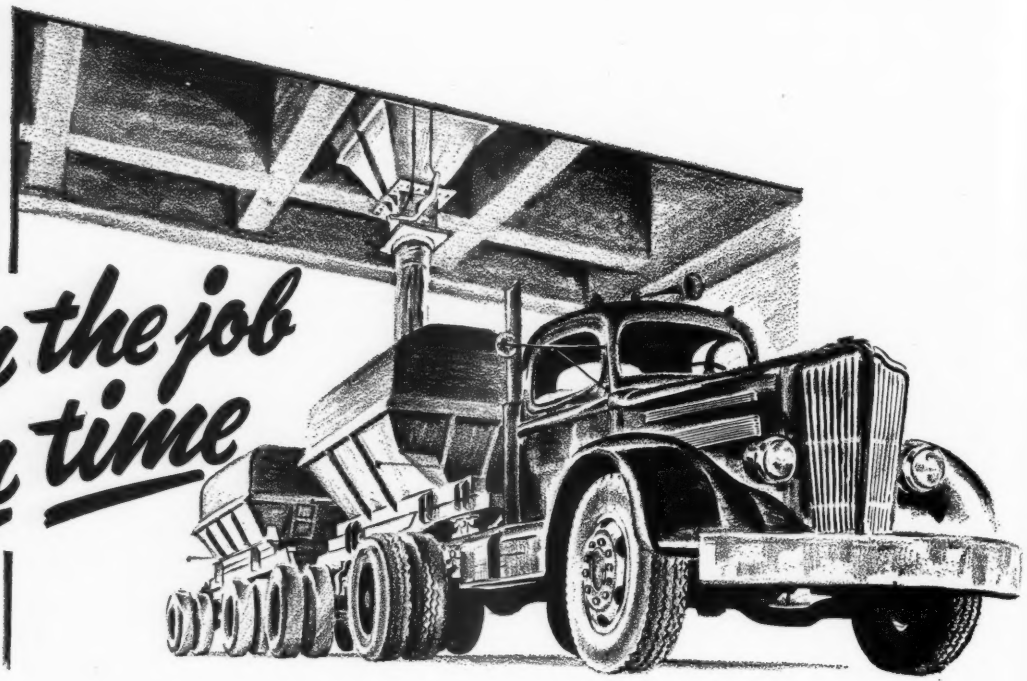
It is recognized that oil recovery research cannot be directed effectively until it is possible to evaluate better the magnitude of the problem, and to determine the conditions which may control its solution. The pioneering work by the American Petroleum Institute, which is being supplemented by the Interstate Oil Compact Commission in a coordinated program, should eliminate in the not too distant future some of the uncertainties which now prevail regarding the amount of oil contained in the reservoirs of United States fields, and the amount which might be susceptible to the application of improved recovery technology. It is suspected that these amounts are enormous, and that oil in place may possibly exceed the total past production plus the present proven primary reserves of the nation.

The recent publication by the Arkansas Oil and Gas Commission of a report on "Secondary Recovery of Petroleum in Arkansas—A Survey," by Fancher and Mackay[8], can be cited as an example of what a state investigation can do to encourage increased oil recovery. This report shows that the secondary reserve of Arkansas is almost equivalent to the recognized primary reserve, a most significant fact when the current low rate of discovery of new fields is considered.

The study of recovery possibilities of Arkansas oil fields can be commended to every state which may be concerned about the future of its petroleum industry. The results of this study, also, provide convincing evidence that there need be no conflict in purpose or objectives between research sponsored by the State and industrial research. Arkansas has made a definite contribution of basic information to its oil industry which would have been difficult and expensive for any individual or company to duplicate. At the same time, this work in no way discourages private initiative, and, as a matter of fact, the encouragement that has been given to industry to utilize more effectively the proven resources of the state under the enlightened oil and gas laws of Arkansas, which have served as a model for legislation in other states, is an example of true conservation that deserves profound appreciation.

It is quite probable that the average American never gave thought that there might be any scarcity of oil until he was given a book of coupons during the war years and was told how much and for what purpose he could drive his automobile. For this reason, it is, perhaps, unfortunate that it is not possible to observe directly the depletion of oil and gas reservoirs. The significance of soil erosion, destruction of forests, and depletion of mineral resources occurring at the surface cannot be easily overlooked, and such loss to the nation of valuable resources is generally recognized

Seaboard Oil Co.'s well No. 6-1 in the Lawndale Area, San Joaquin Drilling Co., contractors. Rear row, left to right: Elmo Knight, derrick; J. C. Rineer, driller; Jack Knight, rotary helper; front row, left to right, Everett Bilyen, pipe racker; John P. Rineer, cat head.



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and understood. If we could be provided with the same ability to observe the production of oil, the fact would be most impressively revealed that petroleum is very abundant, that the supply is usually not exhausted when primary production has declined to a marginal stage, and that all which is needed to make at least some of this remaining oil available is recovery technology which may be applied profitably. Therefore, it may well be that actual shortages of oil will serve a good purpose by emphasizing that special measures to augment the present available crude supply will be necessary to provide security for any emergency which can be anticipated.

If proven sources of oil can receive adequate study by inventive technologists, the United States will be provided with a form of creative mechanism which so far, in the entire history of the country, has never had to admit failure.

The notable part that the American Petroleum Institute has taken in the study of methods for increasing oil recovery is certainly deserving of recognition both by the government and by industry. From its inception, the work of the Standing Subcommittee on Secondary Recovery Methods has received unfailing and enthusiastic support from the officers and directors of the Institute and from the petroleum industry. Had it not been for this support and cooperation, it would not now be possible to discuss with any measure of assurance the manner in which improved recovery technology may help to provide oil for the needs of the United States and for its defense.

Acknowledgments

The writer is most grateful to Kurt H. Andresen, George H. Fancher, Gordon H. Fisher, E. T. Heck, and L. F. Peterson, officers of the Standing Subcommittee on Secondary Recovery Methods, for helpful advice in the preparation of this paper.

[1] API Committee of Eleven (J. Edgar Pew Chairman), "American Petroleum Supply and Demand" (A Report to the Board of Directors of the American Petroleum Institute), McGraw-Hill Book Co., New York, 1925.

[2] Report of Economics Advisory Committee, "Interstate Oil Compact Quarterly Bulletin," Vol. VI, Numbers 3 and 4, pp 88-90, December, 1947.

[3] As reported in The Oil and Gas Journal, January 8, 1948, pp 38-39.

[4] R. L. Minckler, "The California Oil Outlook," AIME, Petroleum Division, Los Angeles Meeting, October 24, 1947.

[5] W. B. Berwald, "The Economics of Secondary Recovery," API, 27th Annual Meeting, Chicago, Illinois, November 12, 1947.

[6] As reported in The Oil and Gas Journal, February 5, 1948, page 39. Also see: Bruce K. Brown, "Petroleum's Relationship to National Security," World Petroleum, January, 1948, pp 59-61.

[7] Report of the Advisory Committee on Secondary Recovery, "Interstate Oil Compact Commission Quarterly Bulletin," Vol. VI, Numbers 3 and 4, page 91.

[8] George H. Fancher and Donald K. Mackay, "Secondary Recovery of Petroleum in Arkansas—A Survey," Arkansas Oil and Gas Commission, El Dorado, Arkansas, 1947.

(a) In the Glossary of Terms and Definitions on Secondary Recovery, page 255 of the API book on "Secondary Recovery of Oil in the United States," Secondary Recovery is defined as follows:

"Secondary recovery is the oil, gas, or oil and gas recovered by any method (artificial flowing or pumping) that may be employed to produce them through the joint use of two or more well bores. Secondary Recovery is generally recognized as being that recovery which may be obtained by the injection of liquids or gases into the reservoir for the purpose of augmenting reservoir energy; usually, but not necessarily, this is done after the primary recovery phase has passed."

This paper was presented at the Spring Meeting of the Pacific Coast District, Division of Production, API, Biltmore Hotel, Los Angeles.

C.N.G.A Announces Arrangements for June Frolic

With R. E. Raasch of OFCCO as chairman of the Entertainment Committee in charge of the event, plans for the 1948 June Frolic of the California Natural Gasoline Association, scheduled for all day and evening of June 5th at the Rio Hondo Golf Club, Downey, have been completed.

The daytime events, with the first flight of golfers teeing off as early as 7:00 A.M., have been rounded out into a mammoth sports fiesta replete with golf, baseball, horseshoes, volley ball and paddle tennis to cater to the fun of every member and guest participating. The evening program is given over to the excellent barbecue dinner which will be climaxed with a rollicking, frolicsome show featuring a galaxy of eye-filling beauty and a thrill and laugh packed into every minute of each act.

F. J. Colton, C.N.G.A. president, pointed out that the affair is open to all the Association's friends in all branches of the petroleum and gas industries, and a cordial invitation is extended to attend and participate in the sports and fun.

The program calls for golfers, under the watchful eye of Coles Bason, to tee off at six minute intervals up to 2:00 P.M. Green fee tickets must be purchased at the club house office. Starting times must be reserved through Ed Millett, Association secretary, at least a week ahead. As usual, prizes for low net, low gross and blind bogey will be awarded.

As is the custom, free beer will be available to members and guests throughout the day. Kegs for serving will be set up at convenient points on the golf course, baseball diamond and sports field.

Already the supply gang, smarting under last year's ignominious defeat by the gas house aggregation, are seeking a DiMaggio or a Gehrig to lead them out of the wilderness of defeat. Always popular, R. D. Sutherland expects that this year's game will again be well attended. Paddle tennis courts will be set up by Charley Rajnus on the grounds just south of the club house, together with volley ball, while the old stand-by, horseshoes, is bound to come in for its share of popularity.

Barbecue dinner will be prepared and served under the trees at 6:30 P.M. The balance of the evening will be given to a show (staged outside, weather permitting) which is said to be one of the finest of its kind ever assembled for the event. In view of the fact that a record turnout is anticipated, those desiring to attend are requested to make their reservations at the earliest possible moment. Tickets, which include dinner, are $5.00, and reservations may be made by phoning Ed Millett, secretary-treasurer of the Association, at VAndike 5521 or by mail to C.N.G.A. offices, 510 W. 6th Street, Los Angeles 14, California.

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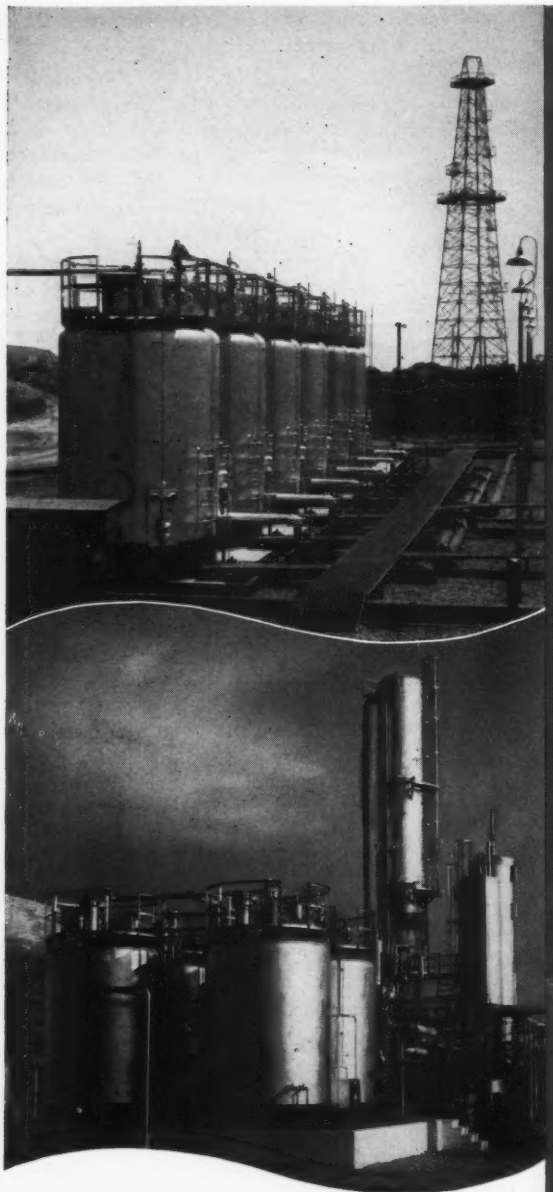

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SO_2 Extraction Unit Completed at Torrance Refinery of General Petroleum Corporation

By S. W. Dickey

With the termination of the recent war civilian demands for high quality petroleum products rose rapidly creating a need for expansion activities within the refining industry. In order to meet requirements for superior grades of diesel oil and kerosene the General Petroleum Corporation commissioned the E. B. Badger & Sons Co. of Boston to design and construct an SO_2 extraction (Edeleanu) plant capable of producing 50 cetane diesel oil at a charge rate of 5,000 bbls. per day with an SO_2 contact rate of 125% or 6,250 bbls. per day. The unit was also designed to process kerosene at a 5,000 bbl. per day rate and naphtha at 4,100 bbls/day. After a period of careful collaboration between Badger and General Petroleum engineers, the plans were drawn up, completion of which was followed by construction preliminaries. Due to uncertainties in material shipments at that time it was decided to delay actual construction activities until 90% of the equipment had been delivered to the site. When this had been accomplished, construction was commenced and erection of the plant was pursued with excellent speed and efficiency, requiring an elapsed time of eight months to complete the job.

Process

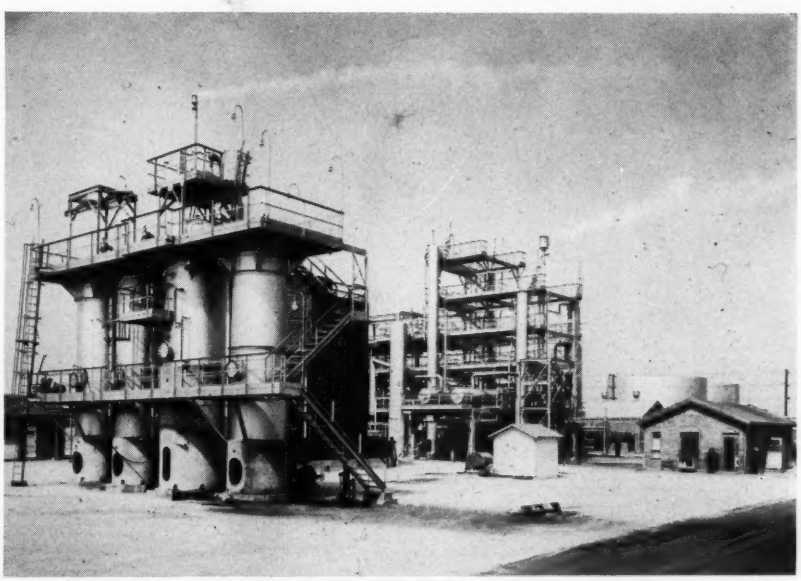
The Edeleanu process is based on the selective solvent principle employing liquid sulfur dioxide as the extraction agent. Essential features include a treating tower for contact of oil and SO_2, evaporator systems for recovery of SO_2 from raffinate and extract streams, facilities for continuously drying the SO_2, and a filter deaerator system for removing moisture and air from the charge oil. A refrigeration system must also be included due to the necessity of maintaining a low treating temperature. Liquid SO_2 has the property of extracting compounds of high carbon to hydrogen ratio such as aromatics and olefins. Removal of these compounds is desirable since their presence causes a diesel oil to have a low cetane number and impairs the burning qualities of a kerosene. Also, compounds containing sulfur, nitrogen, and oxygen are removed which further improves product qualities.

Oil and SO_2 continuously enter the treating tower where they are intimately contacted and the compounds mentioned above are extracted. At the low temperature maintained for treatment the SO_2 is not miscible with the paraffinic type of hydrocarbons and the SO_2-extract phase forms a bottom layer due to its greater density. The extract solution is then sent to a series of evaporators to recover SO_2; and the raffinate, containing a small amount of SO_2, is treated in a similar manner. Degree of extraction is dependent upon the ratio of SO_2 to oil, temperature of treatment, and intimacy of contact between the two mediums. An increase in SO_2 to oil ratio will result in a greater degree of extraction which means a higher quality raffinate at a reduced percentage yield. In all cases care must be taken to avoid the formation of a single phase which would result from the treating temperature being too high or the SO_2 contact ratio being too low. Importance of treating at a low temperature is evident, but the level to which the temperature can be reduced is controlled by the pour point of the oil.

Plant Description

A description of the flow through the unit can best be accomplished by reference to the accompanying diagram. This drawing shows conditions of temperature and pressure at control points in the system when producing 50 cetane automotive diesel. Operating conditions for both 50 cetane diesel and kerosene production are shown in Table I and yields and properties of the two commodities are given in Table II.

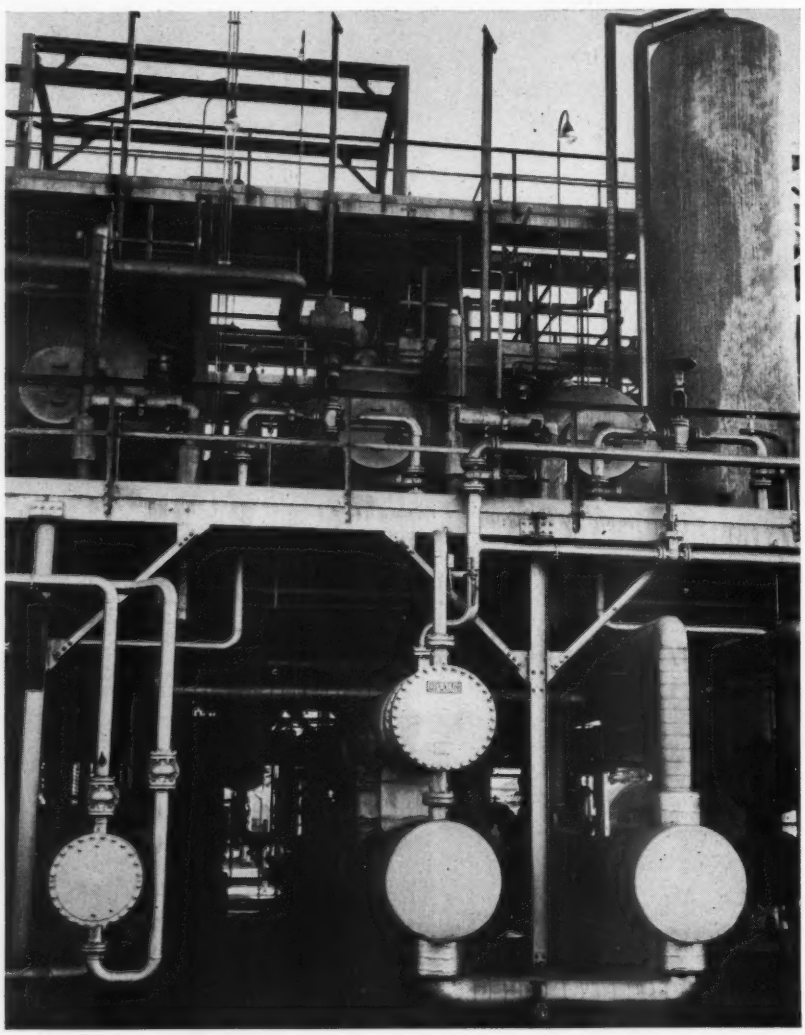
Charge stocks are stored in tanks remotely located with respect to the SO_2 unit but conveniently located for receiving products cut on the



GENERAL VIEW OF PLANT—The towers in the foreground reading from right to left in the direction of flow are: sand filter, vacuum deaerator, calcium chloride driers No. 1 and No. 2. Back of these towers is seen a section of the mechanical draft cooling tower. Next to the right is the central structure of the unit followed by the compressor house and control house. Tanks in background are shipping tanks for finished products.

crude units. The stocks are then charged to the SO_2 plant by pumps located at these tanks. Extreme care must be taken to assure the charge stock being completely free of water and to this end diesel oil is given an air blowing treatment before pumping into the SO_2 plant charge tank. A perfectly clear stock is obtained in this manner. Kerosene is given a caustic treatment to extract naphthenic acid as it comes from the crude units and a short period of settling in the charge tanks is a satisfactory means of drying this stock. Naphthenic acid is not removed from the diesel oil ahead of the SO_2 treatment because of the difficulty of eliminating the resultant cloud. Therefore, the naphthenics are present during treatment and concentrate in the extract product from which they are recovered by a caustic wash. The naphthenic acids are removed from these stocks for the purpose of obtaining the acids for further refining and subsequent marketing.

Further feed drying facilities are located within the boundaries of the SO_2 plant. The feed passes first through a sand filter which is for the purpose of removing any suspended droplets of water entering with the charge stock. Presence of such suspended moisture is very rare because of the elaborate precautions taken to dry the stock. An alarm has been installed in the bottom of this vessel to sound warning if a large amount of water should accumulate. A vacuum deaerator is next in the order of flow. This is for the purpose of removing dissolved air from the oil. High and low level alarms are part of the equipment, and the oil level is held constant automatically. From this vessel a pump takes suction and charges the oil through a cooler to two calcium chloride driers in series and thence to the unit proper. A water alarm has been installed at the outlet of the cooler as additional safety against water entry. The driers are for the purpose of removing final traces of moisture from the feed and can be operated in series, parallel, or singly although the usual flow is in series. At present, for purposes of the test, the flow is up through the first drier and down through the second. It is believed that upflow prevents packing of the calcium chloride granules, but it is advantageous to operate the second drier downflow to prevent carry-over of the drying agent into the unit. The filter and driers are frequently checked to remove water from the system and periodic inspections of the driers are necessary to determine the rate of calcium chloride usage. After a period of four months, the first drier had shown a loss of ½ the original calcium chloride content which amounted to a usage of 12.5 lbs. per 1,000 barrels.



CLOSEUP of the cooling and treating section. On upper deck, left to right are seen the charge chiller (a refrigeration vessel), the deaerator condenser (another refrigeration vessel) the raffinate solution accumulator, the treating tower. This tower extends to the ground, but the lower part does not show in the picture because of deep shade.

From the drying system the charge then passes through heat exchange with cold raffinate and thence through the tubes in the charge chiller to the bottom of the treating tower. The charge chiller shell contains liquid SO_2 cooled by autofrigeration which is dependent upon vaporization to the SO_2 compressor suctions. Liquid SO_2 is fed to the charge chiller from the main collector, passing through heat exchange with cold extract solution enroute. SO_2 is then pumped from the charge chiller to the treating tower, entering at the top through a distributing ring and passing down through a section packed with 1¼-inch Raschig rings. Contact is thus made as SO_2 flows downward through the oil, extract solution settling out at the bottom of the tower and raffinate solution passing over the top. Flow of extract solution

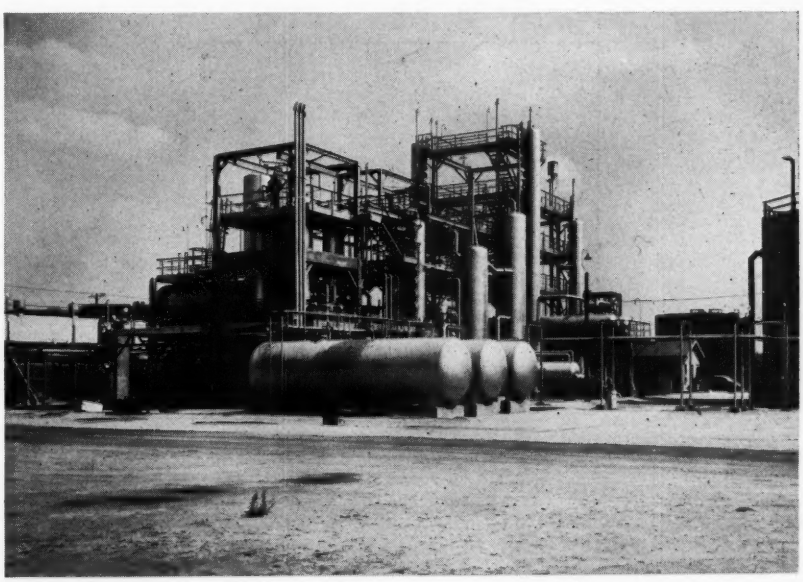
from the tower is regulated by an interface level controller which operates on the gravity differential between raffinate and extract solutions. When producing 50 cetane automotive diesel oil, the extract solution contains 84% (wt.) SO_2 and the raffinate solution 15% (wt.) SO_2.

Raffinate and extract solutions collect in their respective accumulators from which they are sent to evaporators to recover SO_2. Three of these evaporators are used for processing raffinate solution, while four are used for extract. Both systems employ a condenser pressure evaporator, low pressure evaporator, and vacuum evaporator, but the extract system also uses a high pressure evaporator. Reboilers incorporate temperature and level controllers and are operated on 175 lb. steam. Advantage is taken of the pressure differential between each tower to transfer liquid through the system instead of using pumps. Extract is pumped from the accumulator at the treating tower through heat exchange with SO_2 feed followed by heat exchange with SO_2 vapor from the high pressure evaporator and next with hot extract from the vacuum evaporator. Final heat adjustment before entering the high pressure evaporator is made by a heater operating on ten pound exhaust steam. The heat applied at this point is controlled automatically to hold a 200 PSIG pressure in the vapor of the high pressure tower. Vapor from the high pressure tower is condensed by heat exchange with incoming extract solution and with bottoms from this tower which have cooled by flash to the 80 lbs. pressure of the condenser pressure tower. A portion of the SO_2 liquid formed by the vapor heat exchange with incoming extract solution is used for reflux to the high pressure tower. Excess liquid from this source plus that from the condenser pressure feed exchanger is accumulated in the high pressure SO_2 collector and used for reflux to the two condenser pressure evaporators and the SO_2 drier. Excess SO_2 in the high pressure collector is transferred to the main collector by a level controller. Extract next flows on level control to the condenser pressure evaporator which operates at sufficient pressure to condense the overhead SO_2 vapors, joined by vapors from the raffinate condenser pressure tower, at the cooling water temperature. A portion of the vapor is diverted by means of a remotely controlled butterfly valve to furnish feed vapor for the SO_2 drier.

The extract low pressure evaporator takes its feed from the condenser pressure reboiler and operates at compressor suction pressure which is on automatic control. Vapors from the raffinate low pressure evaporator join this line. The low pressure evaporators are furnished reflux from the main SO_2 collector. Extract next flows to the vacuum evaporator where final traces of SO_2 are removed. Vapor from this tower is joined by vapor from the raffinate vacuum evaporator enroute to suction of the vacuum pumps. These pumps discharge into the suction of the SO_2 compressors along with vapors from the deaerator condenser, charge chiller, and low pressure evaporators. Discharge from the SO_2 compressors enters the condenser pressure vapor line which conducts vapors into the condensers. Liquid SO_2 from the condensers is then returned to the main collector to be used again for circulation in the process. The vacuum evaporators are furnished reflux from finished raffinate and extract streams respectively which have been chilled by passing through tube bundles in the deaerator condenser. Finally, extract is pumped from the vacuum reboiler through heat exchange with incoming extract solution, followed by a cooler, and then passed through a caustic treating shell and into storage.

Raffinate solution is pumped from its accumulator through heat exchange with incoming oil charge, then through heat exchange with hot oil from the raffinate vacuum evaporator. It next enters the raffinate condenser pressure evaporator and passes through the series of evaporators in the manner described for the extract system. Oil from the raffinate vacuum reboiler exchanges heat with incoming raffinate solution, is further cooled by a water cooler, and pumped to storage.

Extract and raffinate vacuum evaporators are operated in a manner to yield products completely free of SO_2. To do this it is necessary to operate the vacuum reboilers at temperatures sufficient to boil the light front ends of the oil as an aid in stripping out SO_2. The temperature is fairly critical since too high a temperature will drive oil into the vacuum vapor trap and too low a temperature will permit the presence of SO_2 in the product. A 3'-6"x28' steel tower is used for air



A CLOSER VIEW of the central structure showing the SO_2 storage tanks, one of the four SO_2 condensers, SO_2 drying tower and extract evaporators.

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blowing the raffinate to remove the SO_2 when it appears in the stock during periods of upset. This tower has been fitted with five bubble trays and is connected to permit oil to flow down from the top against a stream of air rising from an inlet at the bottom. An air rate of 25 MCF per hour will remove the SO_2 from a diesel raffinate containing up to 50 ppm. If the SO_2 content of the raffinate should exceed the capacity of the air blowing tower, the stream can be treated in a horizontal shell containing an ammonia solution. This treatment yields a cloudy product which requires prolonged settling to clarify and, consequently, is used only during emergencies.

Deaeration

A small amount of air enters the system occasionally and accumulates in the SO_2 vapor sections operating at condenser pressure. This air must be held at a low quantity in order to maintain condenser pressures within practical limits. Removal is effected by means of a line connected to the condenser outlet. This vent gas passes through the deaerator condenser and enters a small pot to permit liquid SO_2 to drop out and be sent to the charge chiller by a level controller. Air is released from this pot by means of a motor valve operated remotely from the control house.

The deaerator condenser shell receives liquid SO_2 from a branch in the line feeding the charge chiller. A layer of SO_2 is held by level control in this vessel and is maintained at a low temperature by being in equilibrium with vapor at reduced pressure connected directly to compressor suction. This temperature, usually about 10°F, is normally lower than that of the charge chiller because vapors from the latter vessel pass through a motor valve before entering compressor suction and are held at a higher absolute pressure. Liquid levels in the charge chiller, deaerator condenser, and extract solution accumulator are indicated by the use of an insulated vertical column with horizontal plugs protruding through the insulation at uniform intervals. This column is attached to the vessel at top and bottom in the manner of a gauge glass, and liquid SO_2 seeking its level in the column will chill the plugs causing them to frost and exhibit a visual indication of the liquid level within the shell. Liquid SO_2 is continually pumped from the deaerator condenser shell into the charge chiller to prevent any increase in the concentration of water due to vaporization of SO_2. Air content of the vapor above the liquid in the main SO_2 collector is continuously recorded in the control house. This device operates from an instrument which transmits the differential pressure between the vapor pressure of pure SO_2 at the temperature of the main collector and the actual pressure in the main collector. This differential represents the air content of the system and is recorded in pounds.

SO_2 Drying

Despite precautions taken to dry the charge oil stream a small amount of water enters from this source, usually at a concentration of about 100 ppm. Moisture also enters the system with the air which leaks in. This water is absorbed by the liquid SO_2 and would soon reach corrosive limits if it were not continuously removed. Drying is effected by use of a 26′ fractionating tower. As was mentioned earlier, the drier is fed by diverting the SO_2 vapor stream from the condenser pressure line. SO_2 vapor enters the drier near the bottom above a short section packed with 1″ Raschig rings. A comparatively high reflux rate is used, and the SO_2 vapor is fractionated out of the water and passes from the top of the drier into the condenser pressure vapor line. A level of water collects in the reboiler which is held at a temperature sufficiently low to minimize vaporization of water. Water is drained to the sewer from the reboiler to hold the level within designated limits. Some SO_2 remains dissolved in the water, but the loss from this source is small.

This method of drying is very effective, resulting in a usual content of .03% (wt.) in the liquid SO_2 feed to the system. This is quite low in view of the fact that the safe upper limit is considered to be 0.1% (wt.). A simple method of test, similar to that used by other west coast refineries, is used in the plant by our operators to determine the water content of the SO_2. In conducting this test 500 cc of liquid SO_2 is measured into a liter flask fitted with a calibrated tip at the bottom. The SO_2 is permitted to evaporate, leaving the water behind in the tip where its volume can easily be measured and converted to percent. The Karl Fischer method has been used by the laboratory to check the plant test, and conclusions drawn from these comparisons are that the plant test is sufficiently reliable for control.

Switching Stocks

Both diesel oil and kerosene stocks have been run in the unit to date, the process of switching from one stock to the other having been effected smoothly. The chief operational changes to be made during such a switch are treating temperture, ratio of SO_2 contact, reboiler temperatures, and evaporator pressures. During these periods the unit is kept running at a uniform charge rate, and oil levels in the sand filter and vacuum deaerator are lowered. The new stock is then cut in and allowed to flow through the unit displacing the previous stock. A time schedule is employed to make control changes at various points in the system at the approximate moment the new stock appears. For example, in switching from diesel oil to kerosene the treating temperature should be reduced only after the diesel oil has been displaced to avoid getting close to the pour point of the diesel. At the time the kerosene reaches the vacuum reboilers the absolute pressure on this equipment must be increased from 60 mm Hg to 190 mm Hg to avoid flooding the towers. Similar considerations must be employed when going from kerosene to diesel stock. Diesel oil from the SO_2 plant is sent directly to storage ready for marketing, but kerosene raffinate requires further treatment. This product meets all specifications except the lamp test and is sent to the acid treating section of the refinery where it is given treatment with 98% sulfuric acid. The lamp test is thus improved, and the finished product meets superior grade kerosene specifications.

Modern Features

The unit embodies latest features

in SO_2 extraction plant design. In contrast to early plants using shell type evaporators, the General Petroleum unit uses fractionation towers equipped with bubble trays for the purpose of recovering SO_2 from product streams. SO_2 drying by use of concentrated sulfuric acid has been used by many plants since the inception of the process, but the more modern method of bubble tower drying is used in this plant because of its simplicity and trouble-free operation. Lines, shells, and towers in the plant are of carbon steel with the exception of the drier, lead lined upper section of the extract low pressure evaporator, and lead lined sump tank. All valves in service where SO_2 may be present are trimmed with stainless steel.

Evacuation lines are connected to vessels and lines in SO_2 service and lead to a manifold which permits suction through SO_2 compressors and vacuum pumps or entry into a sump tank which can be evacuated by means of an electric pump. Drain lines from vessels and lines are also connected to the sump tank which can be drained to the sewer, or the contents can be transferred by pressure into the extract low pressure evaporator if dry oil or SO_2 is present. Flushing oil is used on glands of liquid SO_2 pumps, extract solution pumps, and raffinate solution pumps. Purge oil is applied to the SO_2 flow controller, treating tower interface level recorder, and drier feed rate recorder. Fischer & Porter rotameters coupled with indicating transmitters and receiver recorders are used for controlling reflux streams. This system has proven very satisfactory for handling small streams which are likely to cover a wide range of rate due to changes in operating conditions. An emergency shutdown valve has been supplied which is operated from the control house and performs the function of shutting off the high pressure steam to all reboilers, closes off the make-up steam control to the exhaust steam line, opens the exhaust steam line to the atmosphere, and closes motor valves controlling oil and SO_2 charge rates. In the event of a sudden necessity for shutting the unit down this provides a convenient means of control. It is also useful for planned shutdowns under some conditions.

A cement pad has been placed around the entire base of the main structure for convenience of operation, maintenance work, and general cleanliness. The structure is equipped with ample stairways, walkways, and platforms, and all exchangers are positioned to permit the tube bundle to be removed onto a solid open area. Chain hoists are located at strategic points to facilitate removal of tube bundles or other equipment.

Cooling water is furnished from an induced draft tower equipped with a temperature regulator oper-

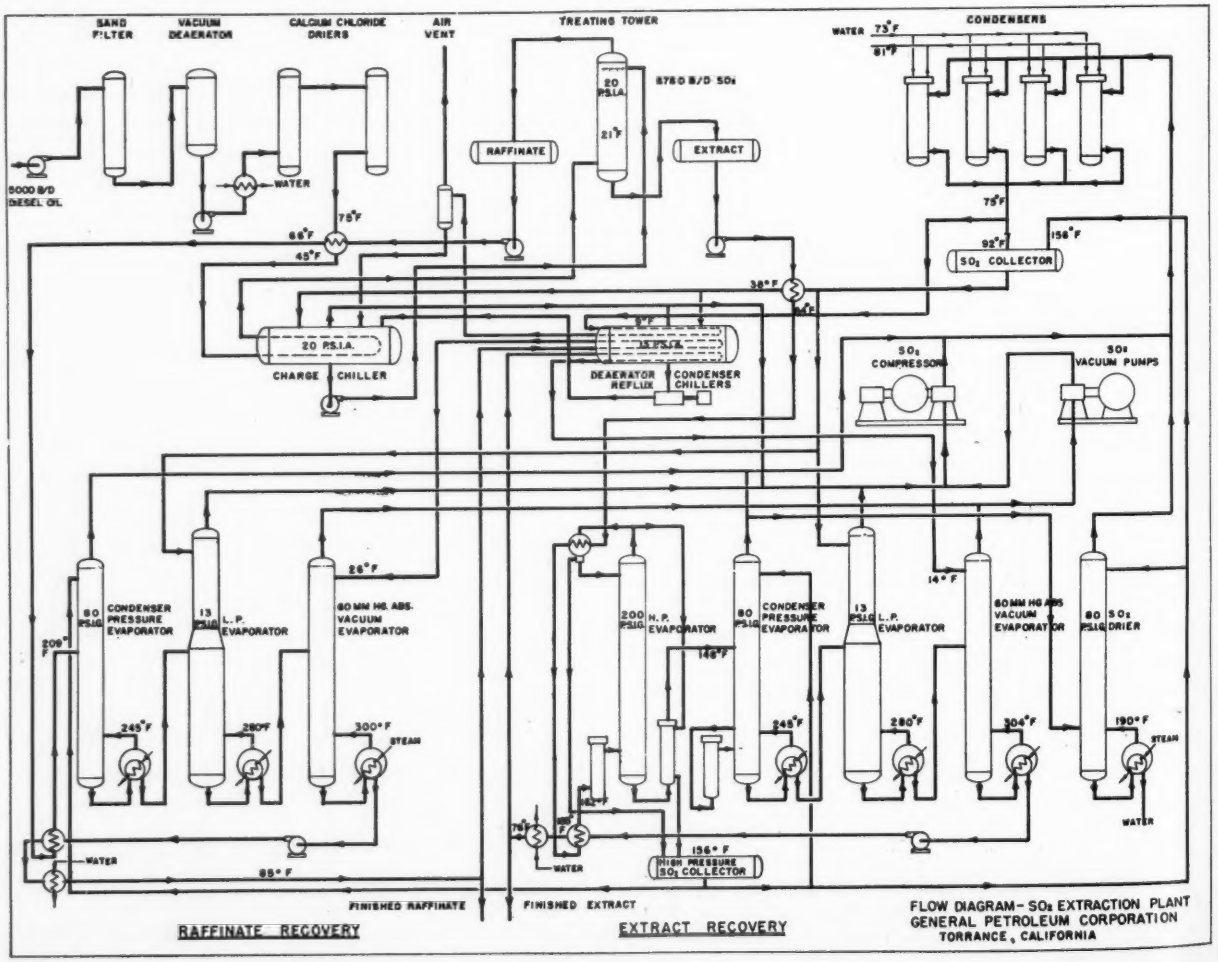

TABLE I
OPERATING DATA

	50 Cetane Diesel Oil	Kerosene
Charge Rate, B/D	5,000	4,550
SO_2 Rate, B/D	6,750	7,300
SO_2 Contact Ratio, %	135	160
Temperatures, °F		
Treating Tower		
Charge Chiller (Shell)	27	14
Deaerator Condenser (Shell)	9	10
Main SO_2 Collector	92	95
High Pressure SO_2 Collector	156	156
Extract Evaporators		
Condenser Pressure Reboiler	245	234
Low Pressure Reboiler	280	280
Vacuum Reboiler	304	306
Raffinate Evaporators		
Condenser Pressure Reboiler	245	235
Low Pressure Reboiler	280	280
Vacuum Reboiler	300	304
Pressures		
Charge Chiller, PSIA	20	15
Deaerator Condenser, PSIA	13	13
Treating Tower Top, PSIA	20	15
Extract High Pressure Evaporator, PSIG	200	200
Condenser Pressure Line, PSIG	80	80
Low Pressure Line, PSIA	13	13
Vacuum Evaporator Line, MM Hg Abs.	60	190

ating a by-pass on the return stream. Normally an electric driven pump is used for circulation of cooling water. A steam turbine driven pump is always ready as a spare and will start automatically, simultaneously sounding an alarm, in the event of failure of the main pump.

Lines, vessels, and exchangers handling cold oil or SO_2 are insulated with from 2" to 4" of vegetable cork. Pumps in this service are insulated with a cork box filled with granulated cork and wax. Equipment in hot service is insulated with an 85% magnesia coating. Towers, lines, and tanks are painted with aluminum. The control house interior is finished with green tile to a height of four feet around the walls. A section separate from the control board houses a wardrobe for operator's clothing. A sink and hot plate are included in this section, and a lavatory is located in an adjacent room.

Initial start-up of the unit was accomplished in September of 1947. Equipment was first pressure tested with oil and then subjected to drying procedures. The testing operations proved the plant to be the result of an excellent construction job, and drying of all vessels and lines was effected by circulation with hot oil followed by operation of the unit using isobutane in place of SO_2. The isobutane and oil were then removed; the entire unit was evacuated; and sufficient SO_2 was delivered, followed by the start of actual treating operations. Diesel oil was used as charge stock during these initial operations, and a product meeting all specifications was produced from the outset. The high quality of construction and success of operation are demonstrated by the low SO_2 usage in the unit to date. An average of 0.14 lbs. SO_2 per barrel of charge oil has been consumed which is among the lowest in the industry.

TABLE II
YIELDS AND PROPERTIES
50 Cetane Diesel Oil

	Charge	Extract	Raffinate
Volume % Based on Charge	100.0	25.0	75.0
Cetane No.	40.0		50.0
Color—Union	3	6	1—
Flash Point, °F	180	180	180
Viscosity—SU/100	35	35	35
Water and Sediment	0.0		0.0
Pour, °F	−30		−15
Sulfur, %	0.34	1.25	0.09
Conradson Carbon in 10% Bottoms	0.04	0.22	0.02
Aromatics and Unsaturates	24	78	3
Aniline Point, °F	139.6 13.9 (Calculated)		169.5
Gravity, API	32.8	20.7	38.2
Distillation			
Initial	390	396	394
5%	434	434	436
10%	446	444	446
20%	458	457	458
30%	467	467	469
40%	477	478	480
50%	489	491	493
60%	503	504	507
70%	519	519	523
80%	539	538	542
90%	566	564	567
End Point	616	628	614
Recovery	99	99	99

YIELDS AND PROPERTIES
Kerosene

	Charge	Extract	Raffinate	Acid Treated Raffinate
Volume % Based on Charge	100.0	23.5	76.5	
Color, Saybolt	14		30+	30+
Color Stability, Saybolt			30+	30+
Color, Union		1½		
Flash Point, °F	140	144	134	
Thermal Viscosity	355	335	385	385
Sulfur	0.19	1.02	0.05	0.03
Conradson Carbon in 10% Bottoms	0.02	0.05	0.006	0.001
Aromatics and Unsaturates, %	18	75.0	2.0	1.0
Aniline Point, °F	128.8	16.9 (Calculated)	156.0	156.4
Smoke Point	18		27	27
72-hour Burning Test			Failed	Good
Gravity, A.P.I.	38.4	26.8	42.5	42.4
Distillation				
Initial	347	345	340	340
5%	370	367	365	366
10%	376	376	376	377
20%	389	391	390	391
30%	401	403	400	403
40%	412	414	411	413
50%	422	425	422	423
60%	432	435	431	432
70%	441	445	441	441
80%	454	458	453	453
90%	467	473	468	468
End Point	500	509	499	500
Recovery	99	99	99	99

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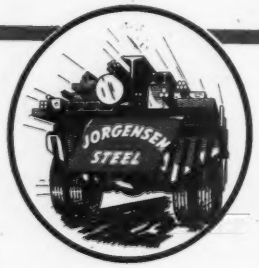
DON'T risk your neck by falling short on steel requirements. Just call Jorgensen who will shoot the works to provide you with the best in steel supplies and service. Whether your job requires carbon, alloy, stainless, tool or some specialty steel, Jorgensen can help you select the *right steel* and then supply it from one of the most complete warehouse stocks in the country. *FOR STEEL, CALL JORGENSEN FIRST!*



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Personalities IN THE NEWS

Dwyer Advanced by Byron Jackson

Mr. George D. Dwyer, former Manager of Export Order Department has been promoted to California Sales by the Oil Tool Division of Byron Jackson Co.

George D. Dwyer

He joined BJ in 1941 and volunteered for Paratroops in 1942. After Army service he rejoined BJ as Expediter. In May of 1947 he was promoted to Manager of the Export Order Department.

Mr. Dwyer completed an extensive shop training course in March. He will operate out of Los Angeles.

Mark Morris, Los Angeles oil land and lease man, has returned to business, following a siege with a ruptured appendix at St. Vincent's Hospital, Los Angeles.

St. Anthony Oil Co., California production organization, which recently extended its operations to Texas, has announced that Delmar Criswell at Olney is the resident geologist for the firm in the Lone Star state.

Thirty years ago on May 15, 1948, Postmaster Thomas G. Patten of New York handed 1st Lieut. Torrey H. Webb two pouches containing 2,457 pieces marked "aerial mail" for the first air mail flight from New York to Washington, D. C. Lieut. Webb reached Philadelphia in exactly one hour and turned the plane over to 2nd Lieut. James C. Edgerton, who set it down in Washington 200 minutes after it left New York.

Three weeks later Lieut. Webb opened the New York to Boston air mail service, and also piloted the first air mail flight from Boston to New York on June 9, 1918.

Torrey H. Webb is now a Vice President of The Texas Company with headquarters in Los Angeles.

Bill Nelson, Texaco operations department at Los Angeles, is treasurer of the California Table Tennis Association and vice president of the Los Angeles Table Tennis Club. Both organizations were just recently formed.

Fred Doman, formerly associated with Phillips Petroleum Co., has opened a district office at Shawnee, Oklahoma, for Macmillan Petroleum Corp. of Los Angeles.

Fred W. Bush is land manager for Union Oil in the Pacific Northwest, where the company is prospecting for oil in the Ocean City and Tokeland areas of Washington.

Russell Ridout, a veteran of 16 years' experience in all phases of the gasoline industry, has joined Hancock Oil Co. He was for 14 years with a major company in the Los Angeles area. He came to Hancock after giving up a gasoline distributorship in Iowa because of his wife's health.

Jo Stafford, famed warbler of the air waves, is the daughter of Crooks Stafford, drilling foreman for the Shell Oil in the Los Angeles Basin. On a recent trip to New York with his nationally known daughter, Stafford was welcomed royally to the big city.

Pictured above are the foreign visitors at the April Meeting of the Los Angeles Chapter of Nomads: seated, left to right: S. B. Duffield, J. M. Leitch, S. L. Hancock, J. R. Coleman and Tom Webb. Standing left to right: Jean P. Lacroix, H. M. Gell, William C. Brown, and H. B. Roberts.

Harold Dresser Joins Marley Co.

The Marley Company, Inc., announces the change of its Los Angeles office address to 810 South Spring Street. Harold A. Dresser recently joined the Los Angeles sales department, taking over his duties May 1 after a two months' intensive training period in the Marley home office in Kansas City.

Harold Dresser

Dresser, who has been associated with cooling tower manufacturers for 22 years, is a native Californian and resides with his family in Lynwood. He is an alumnus of the California Institute of Technology and a member of the California Natural Gasoline Association.

Unique in Standard of California's service records was the presentation recently of gold watches, exemplifying 30 years or more of service, to a husband and wife—Mr. and Mrs. L. R. Wakefield. Eunice Wakefield joined the company in 1914, with Ray following in 1917. Nearly all of their service has been spent in the Seattle district. Ray, an engineer, spent a few years in the Bay are around 1938-1940.

Dr. D. F. Hewitt, staff geologist of the U. S. Geological Survey, spoke at the dinner meeting of the Pacific Mineral Society at the Chancellor Hotel in Los Angeles. He described the Good Springs, Nevada, area.

Howard Supply Company Names Officers

Coincident with the recent announcement by Harold E. Howard that he and his associates had purchased Republic Steel's interest in Howard Supply Company, the following officers have been elected to the Board of Directors:

Harold E. Howard, President
L. Geo. Trembley, Vice President
D. S. Bradbury, Vice President
A. G. Moyer, Vice President and Secretary
J. P. Moseley, Treasurer

The directorate is comprised of the above officers.

The company was formed on September 1, 1937, for the purpose of distributing Republic electric weld oil country goods and line pipe, along with other oilfield supplies, throughout California. At the start, the company had six employees; and now operates ten warehouses and three pipe yards throughout the state and has about 250 employees.

The company has made rapid strides in developing its many exclusive lines and is now rated as one of the major supply houses on the Pacific Coast.

Leon J. Bellanger has been appointed assistant sales manager for Douglas Oil Co. in the Northern division. Bellanger previously was division manager for Petrol Corp. for 14 years.

Edwin Pauley, president of the Petrol Corp. and a leader in national circles of the Democrats, is planning to open the first television station at San Francisco.

Harry C. Wiess, president of the Humble Oil and Refining Co. since 1937, was elected chairman of the board at a meeting of directors in Houston, and Hines H. Baker, executive vice president since 1945, was elected president. The company is understood to be planning to enter the California oil production industry.

In Los Angeles for the spring meeting of the Pacific Coast production division of the API was W. S. Ackerman of Tide Water Associated at San Francisco.

Raymond W. Todd Chairman Of Membership Committee Calif. Natural Gasoline Assn.

Activities and accomplishments of an association depend to a great extent, upon an active, enthusiastic membership. During the fiscal year of 1947-1948 the C.N.G.A. has shown an appreciable growth in active members due to the conscientious work of Ray Todd. It's hard to say "no" to an affable fellow like Ray when he puts the application blank into your hand.

Raymond W. Todd

After graduating from Stanford University School of Engineering in 1936, Ray was employed by the Industrial Fuel Supply Company. This company was absorbed by the Pacific Lighting Corporation in 1940 at which time Ray was made General Field Engineer. During the next five years his progressiveness and ability to handle the problems in the field put him in line for the position of Chief Engineer in charge of engineering and field construction, which he now holds.

Since 1939, when Ray joined C.N.G.A., he has contributed to the association by writing and giving several papers at its meetings. Having played a little football around Palo Alto, he has been having a hard time collecting on a losing team the past few years, but he has a strong hunch that the Indians will give a good accounting of themselves this fall.

Field Development

PREPARED FROM CALIFORNIA OIL WORLD NEWS SERVICE

Los Angeles Basin

Palmdale Try Deeper

In the Palmdale area, Antelope Valley Dev. Co. is prospecting ahead below 3,850 ft. with Del Sur No. 1 in Sec. 26-7n-13w, Los Angeles County.

Elsmere Try Sited

Drilling site for Federal Oil Co.'s No. 1 wildcat in the Elsmere area has been selected some 300 ft. south and 500 ft. west of the northeast corner of Sec. 6-3n-15w.

Seal Beach Well Redrills

Marine Exploration Co.'s second test in tidal land off Seal Beach is redrilling at 4,889 ft. Known as State No. 2, well location is in Sec. 11-5s-12w, Los Angeles County.

Athens Try Rigs

Shell Oil is rigging up to start the drill in Union-Poindexter No. 3 in Sec. 12-3s-14w in the Athens area. In the northwest Athens area, Warren L. Meeker and Russell D. Garner have a location for No. 85-1 test in the section.

Los Angeles Tries Redrill

Richfield Oil is redrilling at 2,275 ft. with Boyle Comm. No. 17-1a in Sec. 35-1s-13w at East Los Angeles, and at 2,116 ft. with L. A. River Comm. No. 1-1B in Sec. 34. Original depths are 4,694 and 4,414 ft., respectively.

Puente Well Pumps Crude

Hugh Alan Bardeen has completed Lautenbach No. 1 wildcat in Sec. 10-2s-10w in the Puente area pumping an estimated 25 barrels of 15.8 gravity crude oil daily, with a cut of 4 per cent. Original bottom is 2,009 ft. and plugged back depth 1,569 ft.

Oceanside Test Drills

Drilling is progressing at 1,273 ft. in Charles F. Holmes' Holmes No. 1 exploratory hole near Oceanside in Sec. 31-11s-4w, San Diego County.

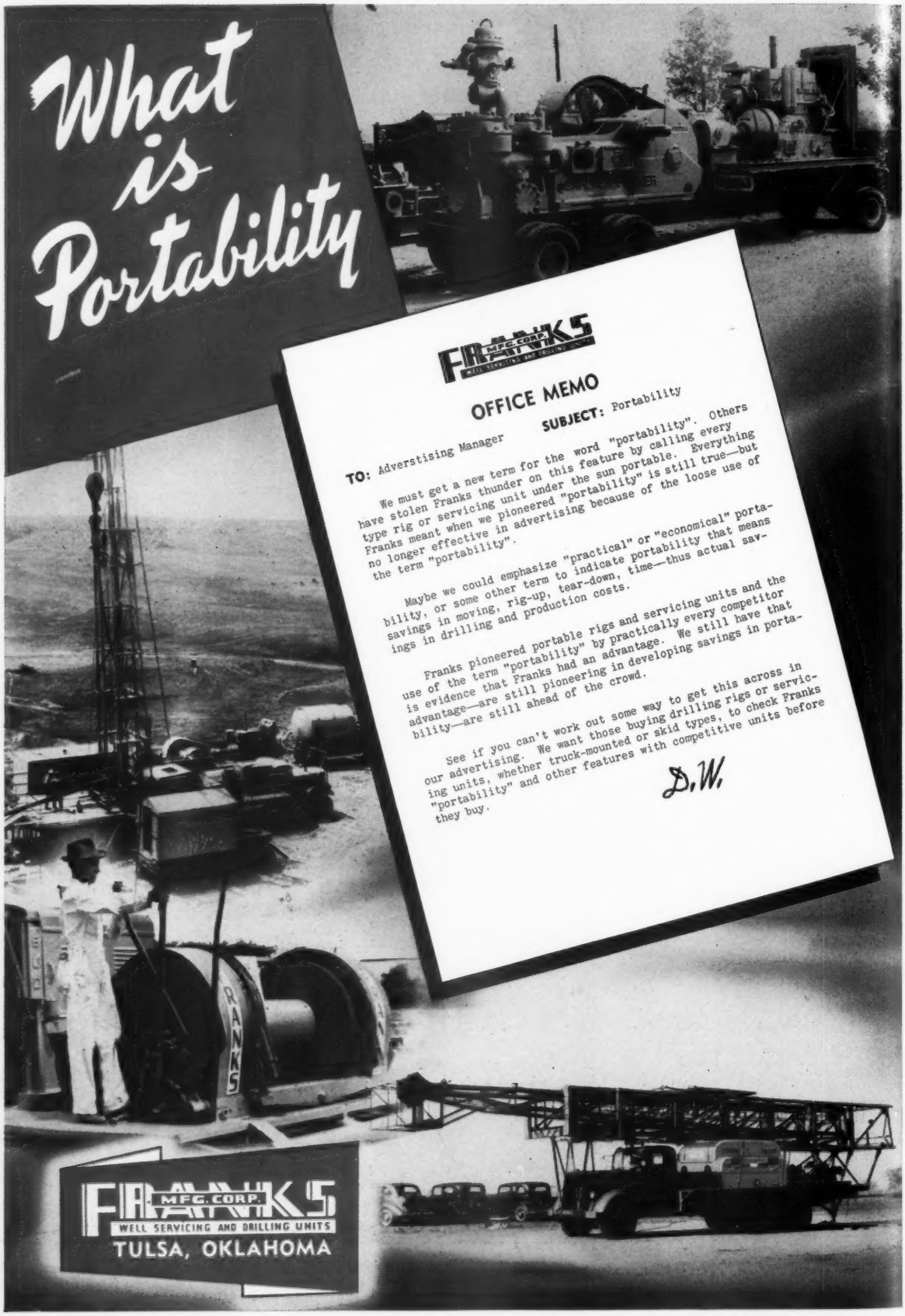
Aliso Canyon Redrill Scene

Honolulu Oil is preparing to redrill Wigdal No. 1 test in Sec. 19-3n-16w in the Aliso Canyon area. The venture formerly flew the banner of Standard of California, which carried it to present depth of 9,525 ft.

Beach Well On Schedule

Royal Petroleum Company, A. W. Lyddon, president, is ready to drill another well near Redondo Beach. Location is near the intersection of Hawthorne and Torrance-Redondo boulevards.

In the Long Beach field at Continental Southern Corp.'s well No. 221, rear row, left to right: C. W. Slate, pipe racker; L. L. Bailey, derrick; R. Langenbeck, driller; front row, left to right: John Wegner, lead tong; W. C. Johnson, cat head.


What is Portability
FRANKS MFG. CORP.
OFFICE MEMO
TO: Adverstising Manager
SUBJECT: Portability
We must get a new term for the word "portability". Others have stolen Franks thunder on this feature by calling every type rig or servicing unit under the sun portable. Everything Franks meant when we pioneered "portability" is still true—but no longer effective in advertising because of the loose use of the term "portability".
Maybe we could emphasize "practical" or "economical" portability, or some other term to indicate portability that means savings in moving, rig-up, tear-down, time—thus actual savings in drilling and production costs.
Franks pioneered portable rigs and servicing units and the use of the term "portability" by practically every competitor is evidence that Franks had an advantage. We still have that advantage—are still pioneering in developing savings in portability—are still ahead of the crowd.
See if you can't work out some way to get this across in our advertising. We want those buying drilling rigs or servicing units, whether truck-mounted or skid types, to check Franks "portability" and other features with competitive units before they buy.
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TULSA, OKLAHOMA

Santa Fe Springs Wildcat Gives Up

Standard of California's Houghton Comm. No. 1-1 wildcat northwest of the Santa Fe Springs field in Sec. 36-2s-12w has been abandoned at 14,444 ft. All formation trials reacted negatively. The company's test well at Sunset Beach is drilling ahead at 3766 ft. It is known as Lomita Land & Water Co. No. 3-1 and is on Sec. 19-5s-11w.

Del Aliso No. 2 test in Sec. 29-3n-16w near Aliso Canyon has been completed at 7,221 ft. for a current yield of 457 barrels of 22.5 gravity oil and 54,000 cubic ft. of gas daily. Frew No. 1-5 wildcat in the section is rigging up. C.S.O. Fee No. 101 in Sec. 2-3n-17w at Pico Canyon, and Six Companies No. 5 in Sec. 2-3s-15w at El Segundo are both locations.

Lawndale Try Ready For Pipe

General Petroleum is down 1,505 ft. with Powell No. 1 test in Sec. 21-3s-14w in the Lawndale area and is preparing to run surface casing. Los Cerritos No. 1 in Sec. 13-4s-13w is a location only.

Inglewood Try Fishing

Basin Oil Co. has cut drill pipe at 9,405 ft. stuck in its Inglewood Comm. No. 7-1 in Sec. 28-2s-14w at Inglewood. Original bottom is 11,123 ft. with plugged back depth 10,711 ft. No. 1-1A in the section is testing water shut off after cementing casing at 9,760 ft. or 5 ft. off bottom. No. 4-1 and No. 8-1 are locations.

Lawndale Try Flows

Swabbing and flowing by heads gas and a little condensate is the latest reported operational move with Seaboard Oil's Johnson No. 3 test in Sec. 17-3s-14w. Gun perforated interval is 7,925-7,930 ft., with 7-in. casing set on bottom at 7,940 ft. Seaboard No. 5-1 in Sec. 20-3s-14w is a location. Barnsdall Oil, meantime, is ready to start work on its Elizabeth Smith No. 1 in Sec. 21-3s-14w.

Whittier Try Starts

Foundation is in for Bert Branch's No. 1 venture in Sec. 34-2s-11w in the West Whittier area. Livingston Drilling & Dev. Co. is awaiting pumping unit for Dewey No. 1 in Sec. 1-3s-11w at East Whittier.

Alondra Park Test Starting

Rig is up for British-American Oil Prod. Co.'s Village Comm. No. 2 wildcat in Sec. 22-3s-14w in the Alondra Park area of Los Angeles County.

Chino Try Drills On

In the Chino area in San Bernardino County, Chino Hills Oil Co. is drilling ahead at 1,762 ft. with Chino Hills No. KB-4 in Sec. 33-2s-8w.

The New John Zink -C B M- BI-MIX BURNER

The John Zink BI-MIX GAS BURNER has been combined with a Steamizer type Oil Burner to produce a highly efficient COMBINATION oil and gas burner identified as Series CBM. It provides approximately the same heat pattern when firing either or both fuels in combination.

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San Joaquin Valley

Kern Bluff Try Abandoned

A quarter of a mile northwest of the Oceanic-Universal Consolidated development, Vedder Petroleum Corporation has abandoned U.S.L. No. 1 test in Section 12-29s-28e at Kern Bluff. The project went to 1,210 feet, topping oil stained Santa Margarita at 953 ft.

McKittrick Active Area

Texas Co. has foundation in for Universal No. 1 wildcat on the Pottenger Anticline in Sec. 19-30s-22e, west of McKittrick. Location is about four miles north of a 7,500-acre block, on which Western Gulf Oil Co. plans an exploratory campaign. The first well there probably will be drilled in Sec. 7-31s-21e.

A good portion of the Western Gulf property was leased from Milton Kane of Morris Estates Co. in San Francisco. Ralph Arnold is among leading geologists who have studied the prospects of the area.

Near Texaco's Universal project, Union Oil is drilling at 2,075 ft. with R. & K. No. 1 in Sec. 34-30s-21e. Circulation difficulties are reported. Signal Oil & Gas, meantime is exploring ahead at 5,675 ft. with Signal-Pike No. 1 in Sec. 10-30s-22e. Northwest of McKittrick, General Petroleum is reaming with Ninkovich No. 62-9 in Sec. 9-30s-21e, after coring to a bottom of 11,166 ft.

Cuyama Valley Adding Interest

Oil prospects at Cuyama Valley have attracted added interest.

Ned Barmore's Woods No. 1 test in Sec. 9-10n-28w is coring gray sand at 2,820 ft. Anderson & Associates is making hole at 560 ft. in Colgrove No. 2 in Sec. 30-11n-27w. On the Russell Ranch, Richfield is coring at 3,059 ft. with No. 1 in Sec. 5-10n-27w. The company's Koch No. B-1 in Sec. 29-11n-28w is grading location. North of the ranch, Bandini Petroleum is grading roads for Azzarello No. 1 in Sec. 34-11n-26w.

Paloma Field Adds Acreage

Richfield has pushed out the northwest limits of the Paloma field by completing M. & L. No. 78-24 in Sec. 24-31s-25e. The project started off from 11,334 ft. with a flow of 720 barrels of 42 gravity oil along with 3,450,000 cubic ft. of gas a day. Seeking to extend the field still further, location for KCL-Lakeside No. 67-24 has been staked in the section. Widening of the field by Richfield also was of benefit to Ohio Oil and Kern County Land Co.

Ant Hill Try Digs

Drilling has reached 3,290 ft. in Barnhart - Morrow Consolidated's DeMille-Portals No. 1 test in Sec. 33-29s-29e in the Ant Hills area, Kern County.

McDonald Anticline Wildcat Completing

Independent Exploration is giving the finishing touches to Layman No. 2 in Sec. 18-28s-20e on the McDonald Anticline in Kern County. The well, which is bottomed at 1,638 ft., showed enough on formation trial of the interval of 1,372-1,404 ft. to indicate a new discovery. The company's Swan No. 3 in Sec. 15-28s-28e in the Sharktooth area is standing with casing cemented at 2,752 ft. Top Vedder oil sand is placed at 2,752 ft. and hole is bottomed at 2,764 ft. The well is on an 80-acre piece, owned equally by Independent and Morton & Kohlbush.

Mtn. View Well Drills

Northwest of the Mountain View field, St. Anthony Oil Co. and Independent Exploration are drilling at 4,125 ft. with McDonald No. 35-18 in Sec. 18-30-29. Richfield's KCL No. F-1 test in Sec. 16-30s-28e is drilling at 5,273 ft.

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Elkhorn Valley Test Strikes Oil

In the Elkhorn Valley area, Elkhorn Oil & Dev. Co. is in oil sand at 2,159 ft. with Norris No. 1 wildcat in Sec. 28-32s-22e. Oil sand was topped at 2,151 ft.

Guijjaral Test Listed

Location has been made for Barnsdall Oil's Fred Smith No. 1 explorer in Sec. 34-20s-16e at Guijjaral Hills, Fresno County.

Tulare Try Cores

Near Visalia in Tulare County, W. J. Carter is coring at 1,460 ft. in Carter-Chedester No. 1 wildcat in Sec. 21-18s-25e.

San Emigdio Test Swabbing

Mud and salt water with a trace of oil was swabbed from Continental Oil's K.C.L. No. L-2 in Sec. 8-11n- 21w in the San Emigdio area. Original bottom is 13,175 ft. with plug at 11,500 ft. and holes between 11,322-11,342 ft.

Arvin Try Digs

British-American Oil Prod. and Capital Co. have spudded Kovacevish No. 58-A wildcat in Sec. 26-31s-29e in the Arvin area and are drilling ahead at 918 ft. Standard's Tupman No. 2 in Sec. 22-31s-29e is idle at a plugged depth of 7,505 ft. Western Gulf's Di Giorgio No. 3 is a location in Sec. 10-31s-29e.

Turlock Try Starts

Location has been staked for Great Valley Development Company's Thompson No. 1 exploratory venture in Sec. 11-5s-13e near Turlock in Merced County.

Bacon Hills Tests Drill

Seaboard Oil's No. 58-21 at Bacon Hills is drilling shale at 8,335 ft. Drill site falls in Sec. 21-28s-20e. Western Gulf's Spencer A-U. S. No. 18-34 is drilling at 2,800 ft. on Sec. 34-28s-30e.

Coalinga Try Deeper

Sharples Oil Corp.'s Fleishacker No. 84 test in Sec. 1-19s-15e at North Coalinga is drilling at 7,092 ft.

South Dome Test Reams

Standard of California is reaming its S. F. & F. L. No. 4-2 wildcat in Sec. 12-25s-19e at Kettleman Hills South Dome, with hole down 12,448 ft. Van Sicklen No. 45 in Sec. 36-27s-21e at Lost Hills is drilling at 8,279 ft., after cementing protection string at 7,932 ft. Electric log is running in Towle Estate No. 4 in Sec. 7-27s-23e in the Semitropic area. The well cored oil sand and gray sand to present depth of 2,590 ft.

Buena Vista Wildcat Cased

Protection string has been cemented at 10,754 ft. in Western Gulf's B.V.A. No. 18-3 explorer in Sec. 3-32s-25e in the Buena Vista area. Total depth is 10,782 ft.

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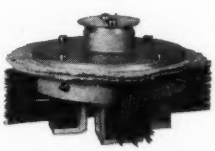

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San Ardo Well Cores Oil Sand

Salinas Valley oil interest in recent days stemmed largely from Jergins Oil and North American Oil Consolidated's Orradre No. 1 test in Sec. 12-23s-10e at San Ardo in Monterey County. The well logged oil sand from 2,120 ft. to a bottom at 2,225 ft. The sand is the best found to date in Salinas Valley.

Location is southeast of Texas Company's Lombardi No. 1 discovery well and the Jergins-North American combination apparently has proved up a wide extension at San Ardo. The entwined interests have under lease more than 5,000 acres in the area.

Orcutt Adds Well

Rice Ranch Oil Co. is preparing to start work on West No. 4 in Sec. 19-9-33 in the Orcutt field. The field was opened up by Union Oil 45 years ago.

Cat Canyon Well Drills

Douglas Oil of California is drilling at 2,713 ft. with No. 9 on the Los Flores lease in Sec. 22-9n-33w in the Cat Canyon field. Interest in the lease is shared with Fletcher Oil & Refining Co.

Stockton Try Logged

Following run of electric log, Amerada Petroleum has set 5½-pipe at an unreported depth in Martenet No. 25-2 in Sec. 2-2n-8e near Stockton, San Joaquin County.

Denverton Venture Tests

Having set casing at 2,210 ft., Honolulu Oil is now testing its McCormack No. 1 gas seeker in Sec. 36-5n-1w in the Denverton area, Solano County. Total depth is 3,010 ft. with the lower portion of the hole lost.

Glenn County Try To Plug

Richfield Oil is preparing to plug Afton Comm. No. 2-2 in Sec. 27-19n-1w in the Afton area of Glenn County, after running electric log to bottom at 2,850 ft.

Conejo Test Will Resume

Ti-Bell Drilling and Roy, Inc. is preparing to resume drilling at 6,900 ft. with Janss No. 1 wildcat on Sec. 33-2n-19w in the Conejo area of Ventura County. The project was idle for some months awaiting drill pipe.

Zaca Area Try Drills

Tide Water Associated's Luton No. 93 in Sec. 29-8n-31w in the Zaca area in Santa Barbara County is

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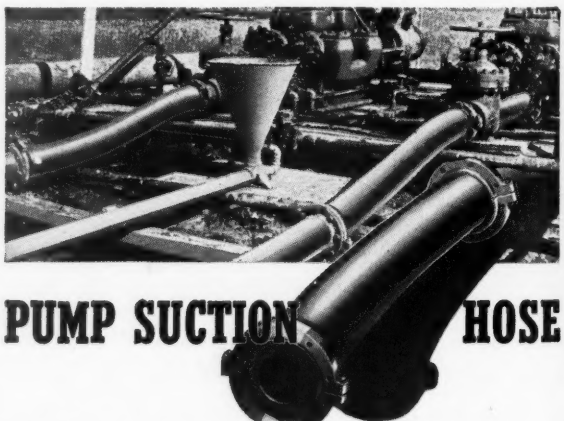

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drilling at 4,937 ft. Chamberlin No. 22 in Sec. 33-8n-31w is standing with casing cemented on bottom at 3,858 ft. Davis No. 24 is a location in the section. Since the first of the year the company has added 14,000,000 barrels of crude oil to its reserves as the result of 1948 operations at Zaca.

Lompoc Try Works

Union Oil is cleaning out at 3,500 ft. in Crandall-Government No. 1 wildcat in Sec. 11-7n-33w at East Lompoc, after a formation trial of the interval of 3,350-3,459 ft. Try at this point showed a weak blow and a recovery of mostly muddy water. The company is drilling Keane No. 1, a water well in Sec. 8-22s-8e near King City in Monterey County. Wickenden No. 2-28 in Sec. 28-9n-32w at Olivera Canyon is rigging up to begin drilling.

Capitan Try Progressing

Water shut off on the 7-in. casing set at 3,896 ft. is under test by Rothschild Oil Co. in Careaga No. 1 wildcat in Sec. 36-5n-31w. Electric log was run to bottom at 3,900 ft.

Guadalupe Try Plugs

Continental Oil is plugging bottom to eliminate sand from its Sand Dune-LeRoy No. 2 wildcat in Sec. 2-10n-36w in the Guadalupe area in San Luis Obispo County. The well was previously completed at 2,759 ft. pumping 26 barrels during a 4½-hour period. However, it soon sanded up. Union and General Petroleum are among those holding leases in the area.

Tar Creek Try Drills

Drilling is continuing on down at 4,344 ft. with Republic Operator's Brunton No. 1-A in Sec. 29-5n-19w at Tar Creek. Cable tool drilling has reached 275 ft. in McGregor-Agnew No. 7-1 in Sec. 7-4n-21w at Ojai.

Ojai Well Completed

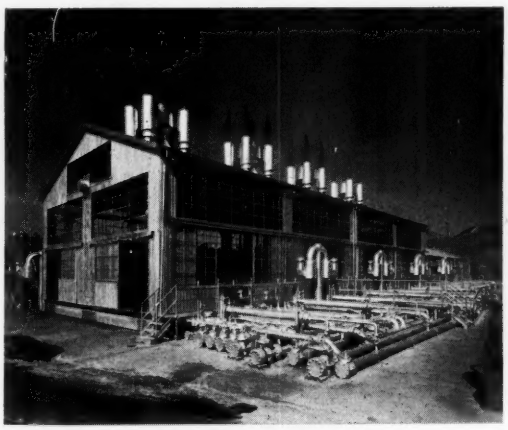
Richfield Oil has completed an excellent producing well in the Ojai area, Ventura County. It was Ojai No. 54 in Sec. 14-4n-22w, which came in from 4,000 ft. for a yield of 294 barrels of 24.2 gravity crude a day, cutting 2 per cent.

Olivera Canyon Wildcat Deeper

Drilling is continuing steadily ahead below 4,000 ft. in Pacific Western Oil's Williams Holdings No. 1 wildcat in Sec. 18-9n-32w in the Olivera Canyon area, Santa Barbara County.

Simi Test Grades Roads

Roads are being graded for M. H. Marr's Marr Ranch No. 1 explorer in Sec. 30-3n-17w in the Simi area, Ventura County. Cal-Ven Petroleum Corp. is down 2,670 ft. with Wiekhorst No. 1 in Sec. 11-2n-18w and cleaning out.



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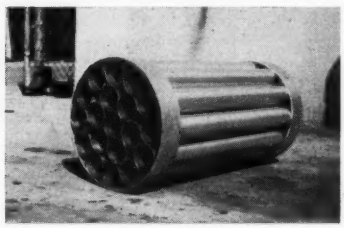

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Goleta Try Drills Shale

In the Goleta area of Santa Barbara County, Honolulu Oil is drilling shale at 9,197 ft. in Honolulu-Signal-Macco State No. 309-2 in Sec. 19-4n-28w.

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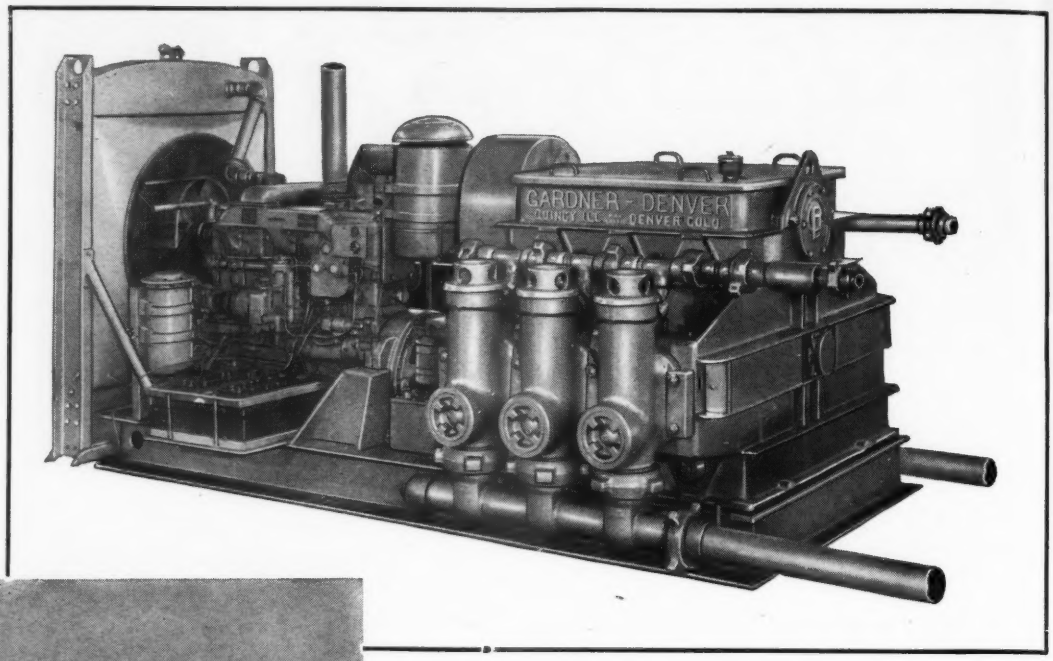
California Oil World's Monthly Summary

CALIFORNIA DEVELOPMENT AND PRODUCTION

	MARCH, 1948, DEVELOPMENT				PRODUCTION	
	Active Drilling Wells	Oil Wells Completed	Initial Production B/D	Oil Wells Completed First 3 Months	Daily Average March 1948	Daily Average March 1947
SAN JOAQUIN VALLEY REGION						
Ant Hill	.....	.....	.....	.....	1,188	1,563
Antelope Hills	.....	.....	.....	.....	1,216	1,426
Bellevue	.....	.....	.....	.....	309	304
Belridge—North	.....	.....	.....	.....	3,694	4,928
Belridge—South	6	2	100	9	6,223	9,941
Blackwell's Corner	.....	.....	.....	.....	122	199
Buena Vista Hills	.....	.....	.....	1	46,066	48,316
Canal	.....	.....	.....	.....	2,019	2,019
Coalinga Group						
Eastside	2	1	111	8	18,522	15,705
Oil City	.....	.....	.....	.....	88	94
Coalinga—Nose	.....	.....	.....	.....	53,439	52,031
Coalinga—Northeast	2	.....	.....	1	9,347	8,185
Pleasant Valley	.....	.....	.....	.....	3,574	4,086
Jacalitos	2	3	1,004	4	5,265	3,995
Westside	2	7	203	12	6,808	6,839
Coles Levee—North	2	.....	.....	2	16,102	16,184
Coles Levee—South	.....	.....	.....	1	3,112	2,734
Edison	2	2	325	6	10,810	11,869
Elk Hills	4	1	60	2	7,456	5,899
Fruitvale	.....	.....	.....	.....	6,649	6,726
Greeley	.....	.....	.....	.....	14,025	10,355
Helm	.....	.....	.....	.....	4,079	4,388
Kern Bluff	2	3	260	9	527	.....
Kern Front	4	1	74	13	9,195	9,074
Kern River	12	24	736	93	12,058	10,031
Kettleman North Dome	3	1	180	4	36,178	38,070
Lanare	.....	.....	.....	.....	1,505	2,390
Lost Hills	5	4	430	28	7,256	4,685
McKittrick Group						
Belgian Anticline	2	.....	.....	26	1,102	.....
Cymric	8	10	401	1	19,229	13,754
McKittrick	1	1	25	3	2,742	2,908
McKittrick Front	.....	1	7	.....	1,740	1,423
Salt Creek	.....	.....	.....	.....	6,094	5,372
Sheep Springs	.....	.....	.....	.....	1,096	1,357
Temblor Ranch	.....	.....	.....	.....	107	122
Midway-Sunset	6	6	460	22	41,913	43,114
Mt. Poso Group	.....	.....	.....	3	12,906	14,550
Mountain View	.....	2	233	4	3,826	5,268
Paloma	6	3	1,553	9	10,606	8,083
Poso Creek Group	.....	2	121	5	3,613	3,844
Pyramid Hills	.....	.....	.....	.....	230	259
Race Track Hill	1	1	311	2	1,889	2,123
Raisin City	1	.....	.....	.....	2,785	2,610
Rio Bravo	.....	.....	.....	.....	12,065	12,699
Riverdale	.....	.....	.....	.....	3,407	4,124
Round Mountain Group	2	3	181	9	7,693	8,797
Strand	.....	.....	.....	.....	725	1,477
Strand—East	.....	.....	.....	.....	497	519
Tejon Ranch	1	1	180	2	3,271	3,007
Ten Section	1	.....	.....	1	7,239	8,005
Union Avenue	.....	.....	.....	.....	264	344
Wasco	.....	.....	.....	.....	161	329
Wheeler Ridge	.....	.....	.....	.....	216	232
Other Fields	3	3	116	11	1,461	496
TOTAL—San Joaquin Valley Region	80	82	7,071	291	433,709	425,852
COASTAL REGION						
Santa Maria District						
Barham Ranch (Los Alamos)	.....	.....	.....	.....	11	.....
Casmalia	.....	1	406	4	1,051	247
Cat Canyon—East	.....	.....	.....	.....	350	420
Cat Canyon—West	3	3	566	9	14,211	11,162
Four Deer	1	1	149	3	612	.....
Gato Ridge	1	.....	.....	.....	3,797	3,571

	MARCH, 1948, DEVELOPMENT				PRODUCTION	
	Active Drilling Wells	Oil Wells Completed	Initial Production B/D	Oil Wells Completed First 3 Months	Daily Average March 1948	Daily Average March 1947
COASTAL REGION—Continued						
Lompoc	1	3	389	9	6,311	4,165
Olivera Canyon	.....	.....	.....	.....	182	.....
Orcutt	1	1	46	7	4,977	4,215
Santa Maria Valley	1	1	109	3	21,244	28,446
Zaca Creek	1	.....	.....	2	840	384
Santa Barbara District						
Capitan	.....	.....	.....	.....	2,794	2,885
Elwood	2	.....	.....	.....	7,216	7,148
Santa Barbara	.....	.....	.....	.....	61	86
Summerland	.....	.....	.....	.....	2	2
Ventura District						
Montalvo West	1	.....	.....	1	153	.....
Padre Canyon	1	1	465	2	5,021	2,800
Rincon	.....	1	324	1	3,365	4,106
San Miguelito	1	.....	.....	1	5,528	5,131
Ventura Avenue	7	1	391	6	50,760	46,356
North Santa Clara District						
Del Valle	4	1	376	4	9,589	8,147
Hopper Canyon	.....	.....	.....	.....	179	131
Oak Canyon	.....	1	27	1	2,089	1,599
Sespe Canyon Group	3	.....	.....	1	228	227
Temescal	.....	.....	.....	.....	559	601
Others	3	.....	.....	2	561	222
South Santa Clara Valley District						
Aliso Canyon	2	.....	.....	2	3,386	3,197
Bardsdale	2	2	250	5	642	397
Newhall-Potrero	5	1	81	2	7,004	6,404
Oxnard	.....	.....	.....	.....	1,584	1,127
Shiells Canyon	.....	.....	.....	1	987	1,041
South Mountain	3	4	561	6	5,246	4,890
West Mountain	2	.....	.....	2	1,010	252
Others	1	1	38	2	827	758
San Luis Obispo, Santa Barbara, Santa Clara and Monterey Counties	1	.....	.....	.....	158	27
TOTAL—Coastal Region	47	23	4,178	76	162,535	150,144
LOS ANGELES REGION						
Brea-Olinda	5	3	634	6	13,793	11,840
Coyote—East	2	.....	.....	.....	4,702	4,971
Coyote—West	4	3	358	6	15,612	15,585
Dominguez	2	1	200	1	13,961	15,446
East Los Angeles	.....	1	530	1	1,268	907
El Segundo	.....	.....	.....	.....	375	500
Huntington Beach	18	18	1,688	67	56,066	49,662
Inglewood	4	1	306	3	11,269	12,087
Long Beach	5	1	80	4	23,359	23,729
Montebello	.....	.....	.....	.....	6,938	7,752
Newport	3	7	628	16	6,569	7,665
Playa Del Rey	.....	.....	.....	.....	1,937	2,092
Potrero	2	1	147	2	1,243	887
Richfield	1	.....	.....	1	6,304	6,741
Rosecrans-Athens Group	1	.....	.....	2	4,671	4,701
Santa Fe Springs	3	.....	.....	2	15,884	16,438
Seal Beach	3	2	1,594	4	11,329	11,121
Torrance	1	.....	.....	1	7,842	8,207
Whittier	1	.....	.....	.....	977	985
Wilmington	15	11	3,317	53	136,574	125,196
Yorba Linda	.....	2	150	2	901	240
Other Fields	3	1	127	3	2,127	1,364
TOTAL—Los Angeles Region	73	52	9,759	174	343,701	328,116
EXPLORATORY						
Outpost Wells	40	.....	.....	.....	.....	.....
Wildcats	15	.....	.....	.....	.....	.....
Gas Wells	1	1	Gas	13	.....	.....
TOTAL CALIFORNIA	256	158	21,008	645*	939,945	904,112

*Includes Gas Wells completed and 91 Drilling Wells abandoned.



HERE IT IS . . . *new* GARDNER-DENVER PL7 Super-Pressure Oil Well Servicing Pump

Super-Pressure—The new PL7 pumps more than 200 gallons per minute at 1,000 pounds per square inch pressure—or approximately 25 gallons per minute at 8,000 pounds pressure.

Compact and Mobile—New principles of design in the PL7 Pump provide new compactness. The pump has six cylinders arranged as two triplex single acting plunger pumps. One bank of three plungers is 3½″ diameter and the other bank is 4¾″ diameter, both having 7″ strokes.

Wide Range of Power and Volume—Pump operates with either bank or with both banks simultaneously—an exclusive feature. Low pressure work is handled with a volume of more than 250 gallons per minute, using all six plungers. High pressure is done with either bank of three cylinders and at reduced speeds can operate at 8,000 pounds pressure.

More Strength—Less Weight—Steel is used in the construction of the pump—permitting maximum strength with minimum weight for the extreme conditions of operation encountered.

For complete information, write Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER SINCE 1859

Dallas • Houston • Tulsa • St. Louis • Los Angeles • San Francisco • New York
Chicago • Pittsburgh • Denver • New Orleans
Continental Supply Co., Continental Bldg., Dallas, Tex.
Republic Supply Co. (of Calif.), 2122 E. 7th Street, Los Angeles, Calif.

With Drilling Contractors

Members have been named to a new cost figures committee of the American Association of Oilwell Drilling Contractors.

They are Ralph W. Marshall, chairman, Ray Powell, Clyde Simpson, Joe Kellogg and Jim Harris, according to an announcement by A. S. (Doc) Hayes, chairman of the California chapter of the AAODC.

The committee's first order of business is centering on the form of questionnaire on drilling costs to be distributed to California contract drillers. The association plans to request contractors to fill out the question form and return it anonymously. These forms will be duly assembled and figures broken down for the benefit and guidance of all members of the association.

National office of the AAODC at Dallas has reported that mud schools sponsored by the association have graduated 2,600 oil industry men since inception of this important educational program. The program was two years old last February. Schools currently functioning in California are in Long Beach, Bakersfield and Taft. The mud courses are designed primarily to train drilling crewmen in proper use and control of drilling fluids. The training is one of a number of educational projects which the association is sponsoring in an industry-wide effort to increase the efficiency of operations associated with producing oil.

Contractors lost one of their best friends when Roy Guthrie passed away suddenly in Bakersfield. For more than 35 years in oil development, Guthrie at the time of his passing was with Tracy Harkness Drilling Co.

New sustaining members of the AAODC include California Production Service Co., Hoover Drilling Co. and Lamb Exploration Co. New associate members are Deigh & Stewart Trucking Co., LeRoi Machine Co., Regan Forge & Engineering Co. and Wagner-Morehouse, Inc.

Brad Mills, executive vice president of the drillers organization, has announced that the next quarterly meeting will be held in Denver on July 19. Members will receive formal notification of the meeting in ample time to make the necessary arrangements to attend, Mills said.

Shell Oil Co. has let contract to Lamb Exploration for the drilling of Winspear No. 15 in the Kern River field.

Pacific Drilling Co. will redrill on contract one of Cadillac Oil Co.'s wells at Huntington Beach.

Santa Maria Drilling Co. is the contractor on Anderson and Associates' Colgrove No. 2 at Cuyama Valley.

Santa Fe Drilling Co. has contracts to drill Howard Park No. 40 for Union Oil Co. in the Athens-Rosecrans field, and to redrill for the same organizatoin Farwell No. 8 at Santa Fe Springs.

Rocky Mountain Drilling Co., contractor is rigging up Frew No. 1-5 for Standard of California in the Aliso Canyon area.

Contracts have been assigned by Union Oil Co. to T. P. Pike Drilling Co. to drill Blochman No. 14 at Orcutt and Bell No. 74 and No. 75 at Cat Canyon.

Tom Bannon, widely known member of the oil fraternity, has joined the Shamrock Drilling Co., with headquarters in the Petroleum Building, Los Angeles.

California contract drillers were well represented at the 25th International Petroleum Exposition at Tulsa. They viewed with interest the bit-weight control exhibit. This device takes much of the guesswork out of drilling wells. It automatically speeds the descent of the bit and drill pipe when the cutting tool encounters softer formations. It also lessens the speed of the bit and allows a more pronounced bite of harder strata.

Elsmere Adds New Test Well

Nelson-Phillips Oil Co. has staked location for Kraft No. 2 in Sec. 31-4n-15w near Placerita Creek in the Elsmere area. The project will explore a short distance southwest of the company's Kraft No. 1 discovery well, which came in from the interval of 518-714 ft. for about 75 barrels daily.

This new pool at Placerita Creek is approximately seven miles west of the oldest well in the state at Pico Canyon.

Yorba Linda Well Spudded

Near Citrus and Eureka streets in the Yorba Linda field, Lyman C. Hisey, Sr., Operator, has spudded Hurley No. 2 in Sec. 21-3s-9w. Present depth is 450 ft.

Placentia Test Digs

Universal Consolidated's Wiley No. 1 wildcat in Sec. 5-4s-9w, three miles southwest of the Richfield area near Placentia, is drilling ahead at 2,743 ft. A previous test of the area failed to produce.

LAUGH THIS OFF!!

A wayfaring gentleman arrived late one night in a small town whose only hotel was completely filled. "No sir," said the clerk," I can't give you a room. The best I can do for you is to give you half of a private dining room. There's a screen across it and a lady has the other half, but I reckon she won't bother you." The traveler agreed that the accommodation would do in a pinch and retired to his half of the room.

Thirty minutes later he ran into the lobby, wild-eyed and pale. "Hey," he yelled to the clerk, "that woman is dead!"

"I know it," said the clerk, "but I'm wondering how you found out she is!"

Husband: "Well, my dear, I have carried you safely over all the rough places of life, haven't I?"

Wife: "Yes, and I don't think you missed any of them."

"Who is your wife going to vote for? A Republican or a Democrat?"

"She'll vote for the man I vote for."

"Well, who are you going to vote for?"

"She hasn't decided yet."

"Gosh, Mary, you look five years older since you took that overnight hiking trip with Bill and the boys."

Mary: "Yeah, I guess I was aged in the woods."

"In spite of her little idiosyncrasies, the fact remains, J. B., that she's a darn good stenographer!"

Three managers of chicken farms in Russia were being questioned by an investigator. "What do you feed your chickens?" he asked the first.

"Corn."

"You're under arrest! We use corn to feed people!"

The second overheard this conversation, and tried to play safe.

"What do you feed your chickens?" came the question.

"Corn husks."

"You're under arrest! We use the husks to make cloth. And you?" he asked, turning to the third man.

"I give my chickens the money and tell them to go and buy their own food."

Mother (entering room unexpectedly): "Why, I never . . ."

Daughter: "Oh, Mother, you must have!"

Parking space: A blank space on the opposite side of the street in the wrong direction.

Speaking of presidential timber—its mostly bark.

The wife of the congressional representative sat up in bed, a startled look on her face.

"Jim," she whispered, "there's a robber in the house."

"Impossible!" was the reply. "In the Senate, yes, but in the House, never!"

"What! You mean to say this fellow choked a woman to death in a night club in front of 200 people and nobody interfered?"

"Yes. Everybody thought they were dancing."

Smart Producers Depend on Jensens

You producers know it takes more than luck to stay in the oil "game." And the oil equipment "game" can be even tougher.

Smart producers—the old timers, especially—avoid many production chances by sticking to Jensens, just as many of them have for 28 years.

After all, 28 years pumping unit manufacturing experience means a unit that can handle any production problem profitably.

See your Jensen dealer or write Coffeyville—it's the smart thing to do.

Stocked by
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EXPORT OFFICE, 50 Church St.
New York City

Tubing Tong Designed For Production and Workover Crews

The Oil Tool Division of the Byron Jackson Co., Los Angeles, recently exhibited their new "Powair" Tubing Tong designed for all tubing up to and including 3½" OD. The new tool has undergone almost a year of rigid field tests and is now incorporated into the Byron Jackson line of oil well tools.

Designed for making-up and breaking-out tubing and light drill pipe joints, the new tool reduces heavy, tiring work with conventional hand tools. Driven by a 5.3 hp vane-type air motor, the BJ "Powair" operates in high gear at 60 rpm and supplies 1062 ft. lbs. stalling torque; operates in low gear at 16 rpm and develops a stalling torque of 4000 ft. lbs. These high rotating speeds and increased torque values are a decided advantage for tighter joints. The automatic features of the new tool give the operator overall advantages in time saved, better teamwork, and greater crew safety according to the manufacturer.

A ring positioning valve and cam provide automatic alignment for instant stabbing or removal from the tubing.

A reversing level is flipped over as the first step in removing the "Powair" from the tubing. The operator then depresses the positioning-valve knob. The rotation of the ring automatically reverses and stops in the open position for instant removal of the tool.

Jaws are interchangeable with one pin change. Three sets of jaws and bushings will handle tubing up to 3½" O D inclusive as well as 2⅜", 2⅞", and 3½" O D drill pipe.

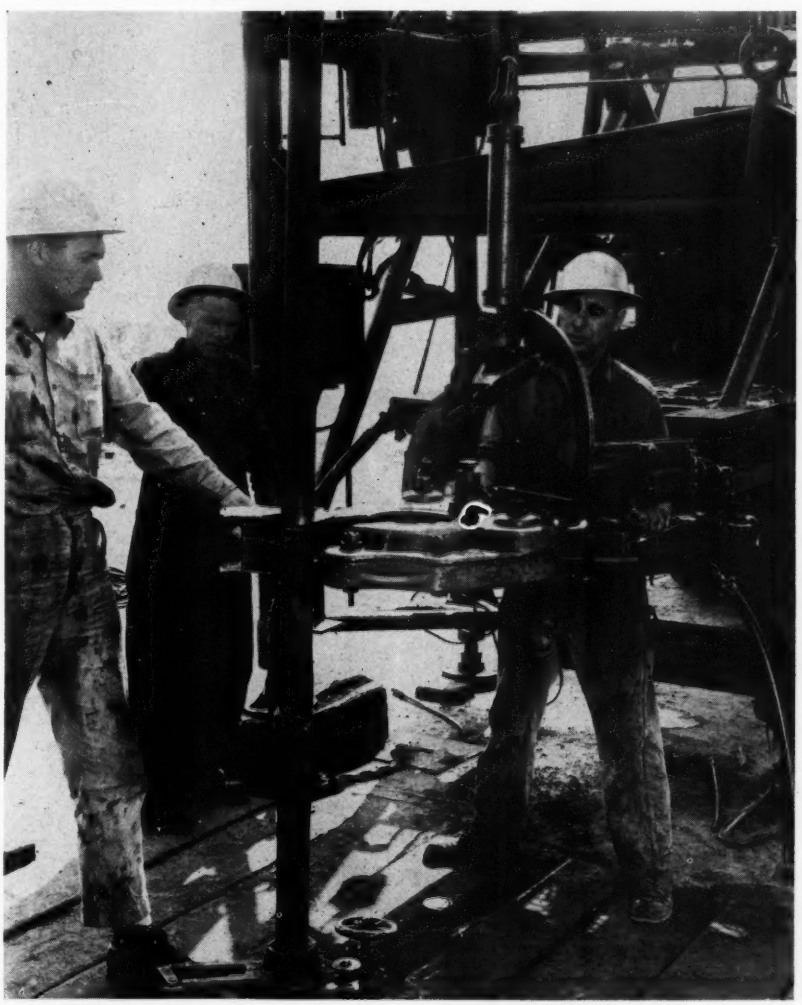
Progress is the American Way of life. The petroleum industry IS progressive.

New Bulletin by National

GAS DRILLING ENGINE. A new 16-page bulletin, No. 315-A, superseding Bulletin No. 315, describes and illustrates the Superior Type 6G-510 Gas Drilling Engine. This six-cylinder engine, 8½" bore by 9" stroke, is rated at 300 HP at 900 RPM for continuous operation.

The bulletin describes the main components of the engine and illustrates construction features. It includes new pictures of the engine which show various modifications of design and changes in accessories since bulletin No. 315 was issued. A new performance chart, covering speeds from 400 to 900 RPM, shows maximum torque, fuel consumption, and continuous, intermittent and maximum BHP. Specifications and dimensional drawings are also included.

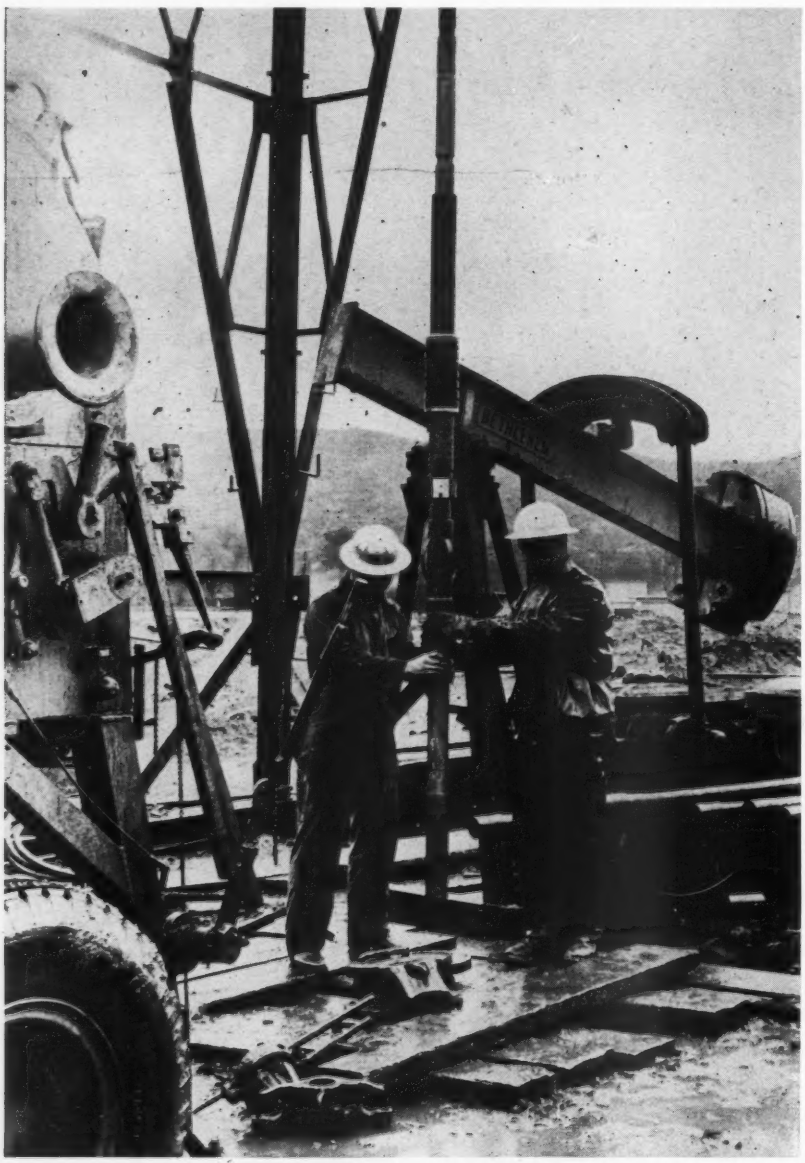
Copies are available from The National Supply Company, Box 899A, Toledo, Ohio.



Byron Jackson 'Powair" Tubing Tong for making-up and breaking-out tubing.

New Pressure Bomb Speeds Well Testing

A pressure bomb with a surface recorder for testing either water shut-off or production has been used successfully in California fields. The new tool reportedly embodies a number of improvements. Instead of having the pressure recorder installed below the packer down in the casing, it is above ground where all pressure variations which occur during the test are instantly registered on a chart. The surface recorder is described as enabling the operator to get his next completion or formation test operation under way promptly while the tester is being withdrawn from the well. In the operation a saving in time of from two to five hours, depending upon the depth of the testing point, is effected, it is claimed.



Lowering the new gun tester and pressure bomb combination into the well. After it has reached a point where the holes are to be shot, a sinker bar and electrical contactor are run into the well on regular perforating line, establisihng continuity between the electric firing assembly in the gun perforator, the pressure-sensitive element, and the electric operating and pressure recording instrument at the surface.

In field operation the testing tool, including the pressure-sensitive element and the gun perforator, is run into the well on the drill pipe or tubing to a point at which the holes are to be shot. Then a sinker bar and electrical contactor is run into the well on the regular perforating wire line. When the sinker bar sets down on a companion connection in the testing tool, continuity is established between the electric firing assembly in the gun perforator, the pressure-sensitive element, and the electric operating and control instruments at the surface.

The recorder instantly shows that the gun has been fired, and starts to draw a curve of the pressure to which the pressure-sensitive element is exposed. The first pressure shown is that of the natural hydrostatic head in the well. After the gun is fired, the operating string is moved upward a few feet and the tester is set, excluding the original hydrostatic pressure from the bomb and exposing the bomb to the formation pressure below the packer.

If the test is dry, there will be little or no change in the pressure shown on the chart with the passage of time; but if the test is wet, the recorder will indicate a continuous increase of pressure until the column of fluid rises inside the operating string to a point where the pressure created by the fluid head equals the formation pressure and the column becomes static, or until the fluid flows over the top of the operating string.

There is nothing new about the tester itself. But with the new pressure recorder, it is believed to offer several advantages. The tester and pressure bomb are made up before the tool is delivered to the well. The only steps necessary before starting into the hole are to screw the gun onto the bottom of the assembly and screw the assembly to the bottom joint of the operating string. The surface recorder is said to show instantly and positively

when the perforating gun is fired, eliminating uncertainty. The visible recorder shows whether or not the tool has plugged. The operator can determine when the fluid column has reached a point where pressures are balanced.

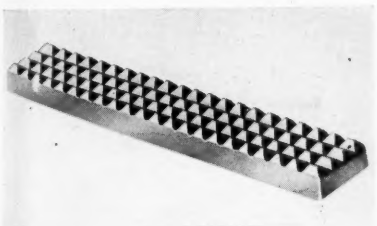
It is claimed that the recorder gives warning of an unusual condition in the well. For example, if the formation pressure reaches a point which is dangerous and might cause a blowout, the tester can be closed and the fluid displaced back to the formation, and, if necessary, additional heavy mud pumped in.

The pressure-sensitive element is described as having no moving parts, no joints, hinges, levers, clocks, springs or gears. It is designed to operate continuously without attention and without giving trouble. The element is located below the inlet valve in the tester and below the screen, and is therefore exposed to the well pressure at all times, regardless of whether the valve is opened or closed.

Mfg. by McCullough Tool Co.

New Tong Dies

Web Wilson Oil Tools, Inc. have perfected a new type of tong die which is now available through leading supply houses under the trade name of "Tiger Tooth." Tiger Tooth Tong Dies have a pyramidal,



pointed tooth pattern that assures a positive, "biting" grip on the hardest tool joints under the strongest pulls. They are especially recommended for flame hardened and hard metal surfaced tool joints or wear subs. The sloping sides and heavy base of the pyramidal shaped teeth give extra strength and backing to each tooth and prevents the Tiger Tooth Tong Dies from easily breaking down even in severe service. They are of the "full length" design that completely fills the die slot in the tong and are reversible to provide extra service life. Tiger Tooth Tong Dies will fit all tongs used in the oil fields today.

Crane Co. Announces New Line of 100-Pound Brass Gate Valves

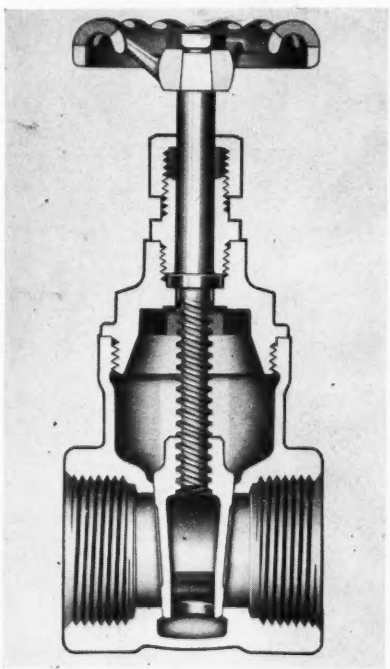
Crane Co., Chicago, announces a new line of 100-pound brass gate valves. These valves are furnished in two types, the No. 410 screwed-end valve in sizes ¼-inch to 2-inch, and the No. 1320 solder-joint valve in sizes ⅜-inch to 2-inch. These are non-rising-stem valves and are intended to replace Crane No. 449½ and 1319, which are being discontinued.

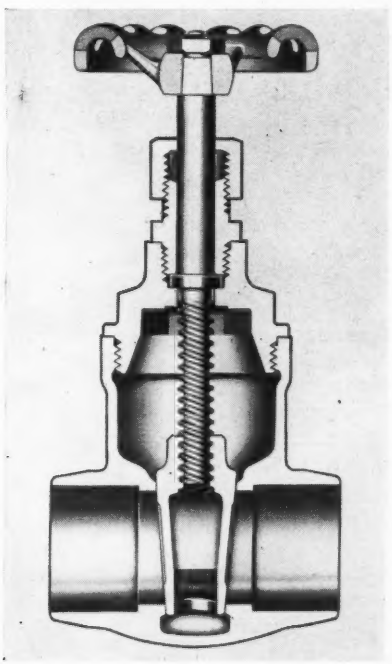
The body design of the new valve is an innovation, incorporating features rarely found in low-pressure valves. The upper portion of the body is cylindical in shape, similar to the design that has been used only in steel valves for the highest pressures. This design combines maximum strength with light weight. The cylindrical shape of the body, in addition to being ideal for resisting pressure, reinforces the seats against the wedging action of the disc. This safeguards against distortion of the body when the valve is being seated.

The ends of the solder-joint design are made to fit closely over hard copper tubing. The close fit enables the solder to flow into the joint by capillary action. The joint is soldered by what is known as "end feeding," the solder being fed into the joint from the outer end of the socket.

The disc is the one-piece wedge type and is guided by means of long guides which assure correct seating. Valve seats are cast as part of the body. The stuffing box is packed with molded asbestos, and can be repacked while under pressure when the valve is wide open.

The screwed valves are recommended for use on low pressure condensate lines, exhaust steam lines and low pressure process steam lines. They also are intended for use in water lines, steam and hot-water heating lines, gas lines and fuel-oil lines. The solder-joint hot-water heating lines, gas lines joint valves are suitable for the same services, except that they are not recommended for gas or fuel oil because of the fire hazard involved in working with solder. Specific working recommendations allow the valves to be used with saturated steam at working pressures up to 100 pounds and for water pressures up to 125 pounds at 200 F. Precautions must be taken, for use at steam pressures and temperatures this high, to make up solder joints with high-melting-point solder.

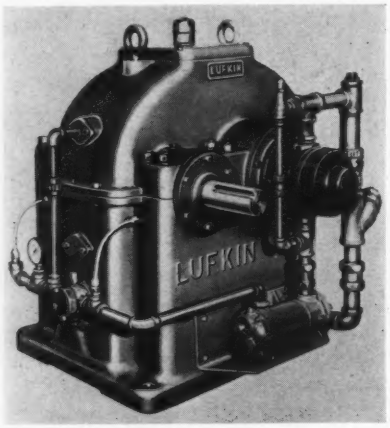




Lufkin Issues New Gear Catalog

Announcing a new source of supply for users of industrial speed reducers and increasers, Lufkin Foundry & Machine Company, Lufkin, Texas, recently issued a new gear catalog of information and data concerning a complete line of Industrial Herringbone Gear Reducers and Increasers.

This catalog states that deliveries can be made promptly—within ten weeks on most sizes and within 16 weeks on any size.



One of the three types of Lufkin Industrial Gear Assemblies is shown here. These High Speed Gear Reducers and Speed Increasers are built in 33 sizes with ratios up to 12:1.

Long recognized as a manufacturer of quality and dependable gear units, Lufkin now offers not only a new and complete standard line of horizontal parallel-shaft Herringbone Gear Speed Reducer and Increasers, but builds also a Standard Lufkin Gear Unit Assembly of this type for all power transmission jobs, deliveries for which can be made promptly, according to Lufkin officials.

Lufkin for the past 25 years has manufactured heavy duty speed reducers for oil field pumping service, and for many years has produced large quantities of special gear reducers and speed increasers for a variety of industries.

Lufkin gear assemblies are available in three standard types, according to the catalog announcement. The Single Reduction Gear Speed Reducers are built in sizes ranging from 3 to 500 horsepower with any gear ratio up to 10:1. Double Reduction Gear Reducers are built with a range of ratios from 10:1 up to 75:1 in sizes from 1 to 300 horsepower. High Speed Gear Reducers and Speed Increasers are available in 33 sizes with any ratio up to 12:1. Loads up to several thousand horsepower can be transmitted; normal speed range is 3600 to 900 RPM. Pressure lubrication and cooling systems are standard equipment.

Lufkin has announced that the new Gear Catalog G-1, furnishing information on horsepower ratings, dimensions, and application data, will be mailed upon request to the executive offices in Lufkin, Texas.

MacClatchie Improves Liner

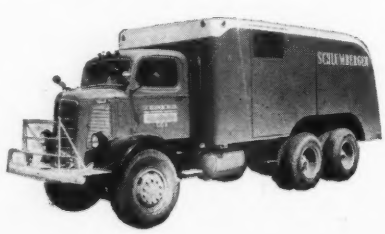
With the most modern honing machines now installed and in operation in the company's plant, MacClatchie Manufacturing Company has announced the production of precision honed mud pump liners. This will result in producing a liner that will have a true concentric bore from end to end. This new pump liner, which will be available in all sizes and designs, will be manufactured with far more precision than heretofor making it an even finer product than their present liner now being used throughout the world.

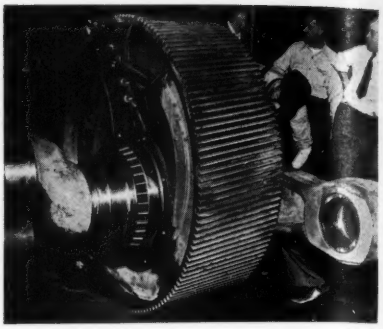
Schlumberger New Well Logging Unit

The New Schlumberger Well Logging unit, in contrast with previous units, is equipped to record simultaneously FOUR SP CURVES on one trip out of the hole. This record is available to the company representatives on location.

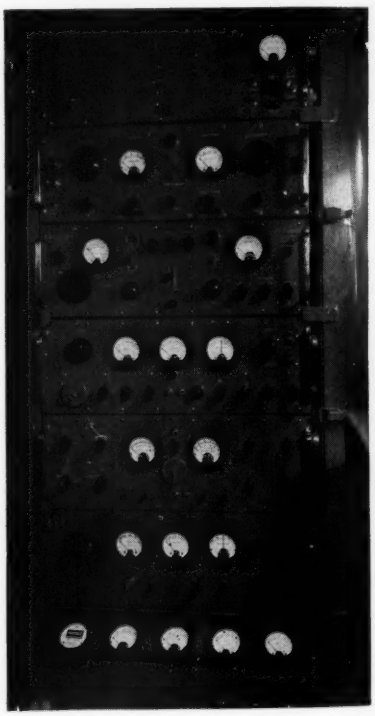
These new units contain permanent panels for all services. From top to bottom:

(1) Open hole Section Logging
(2) Gamma Ray Logging
(3) Photoclinometer & Dipmeter Surveys





The newest and largest Ideal duplex power slush pump (E-700) manufactured by The National Supply Company is driven through this helical gear, crankshaft and connecting rod being assembled in the Toledo shop. This pump will circulate oil well drilling mud to depths as great as 16,000 ft. or more at pressures up to 2480 psi.



(4) Gun Perforating, Side Wall Coring and Casing Collar Locator
(5) Electric Logging
(6) Induction Logging

U. S. Oil Tanker Fleet

As of January 1, 1948 the U. S. has 772 oil tankers with a deadweight tonnage of 10,587,771. The British are next with 482 tankers representing a deadweight tonnage of 5,139,131.